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The Street Railway Convention. To the American Street Railway Association at its Pittsburgh Convention, THE ELECTRICAL WORLD extends cordial greeting. We consider the Street Railway Association as really an electrical body, for the replacement of 25,000 horses by motors in the past year, and the almost daily report of the organization of new electric lines, gives evidence that the days of the horse as a motive power are numbered, and that year by year fewer and fewer street railway men will represent anything but electrical interests. If any further suggestion of the electrical character of such a gathering as the present one were needed, one has but to look at the long list of electrical exhibitors, and the fine collection of electrical appliances that has been gathered together, and besides this the deliberations of the present convention give promise of a more exclusively electrical character in each succeeding year. It was predicted at Buffalo last year that the horse had made his appearance in the proceedings for the last time, and to judge from present indications such is certainly the case. It is a work of humanity as well as of progress to relieve that animal from the onerous duty of dragging street cars at low speed and high cost, and we congratulate all reformed horse-railway men not only on their conversion to electric traction, but in the interest of the society with the long name that watches over the welfare of the beasts they have discarded.

The City and South London Railway. ON another page will be found a somewhat extended account of the City and South London Railway, that forerunner of electric railroading on a large scale which was started about a year ago across the water. Our correspondent was unable to obtain as full details as might have been wished, as the line is still operated under contract with the manufacturers of electrical machinery, who display a truly American ingenuity in concealing all important details. Some useful facts, however, were discovered with reference to its operation, and the description of the line may be considered as accurately representing its present state. Altogether the year's operation has been from an electrical point of view a success, although difficulties have of course been encountered and minor accidents have happened. Perhaps the most interesting feature of the road electrically is the experiment of putting the armatures directly on the car axles. The result has been fairly satisfactory. Though there has been occasional damage to the armatures it has not been of so serious a character as to interfere with the operation of the road. The cause of the trouble is not altogether evident, probably overloading has had as much to do with it as anything, but, on the whole, the usefulness of the gearless motor for that class of work has been effectively demonstrated. The conditions for success, are, however, decidedly more favorable there than on street railways, so that we are not justified in drawing any direct conclusions as to the practicability of gearless motors in regular street car service.

Another Lie Nailed. A FEW weeks ago there was reported from Grand Rapids, Mich., an alleged death from contact with a trolley wire. It was asserted that a truck driver was thrown from his seat by a collision of his runaway team with a telephone pole and that a broken telephone wire falling across the trolley twined itself about his neck and gave him a fatal shock. Were this true it would be a very serious matter indeed, for it would show that the voltage employed on street railway circuits is dangerous to human life. Believing this latest sensational report, which was somewhat widely heralded, to be purely without substantial foundation, the Western representative of THE ELECTRICAL WORLD was sent to Grand Rapids with instructions to investigate and find out the exact circumstances of the accident. His report in full will be found in another column. The report of the coroner's jury was that the death was produced by electricity, and the stubbornness and maliciousness of this assertion may be judged from the report of the physician who made the autopsy on the victim, that death was produced by suffocation, and there was reason enough for such a result. The unfortunate truckman was dashed to the earth, and one of his horses, crushed by the force of the collision with the telephone pole, fell upon him and lay across his chest for eight minutes, while the bystanders, panic stricken at the sight of the telephone wire sputtering in the street near by, rendered no assistance and let the man die from asphyxia before their very eyes. And this is the sort of accident that was charged against the "deadly trolley!" This is not the first false report that THE ELECTRICAL WORLD has shown up in its true colors, and we fear that it may not be the last, but in every case so far the result has been the same, to show that the trolley wire cannot be accused of being dangerous to human life.

A Successful Conduit. So much has been said about the possibilities of the underground conduit for electrical distribution for street railroads that the report by our European correspondent on the Budapest conduit tramway should be of considerable interest to our readers. Apparently in that road Messrs. Siemens & Halske have furnished a successful solution of the conduit problem so far as general methods are concerned. The operation of the system has been exceedingly satisfactory and has given great encouragement to the advocates of that particular system of traction. The conduit road of this country has had so hard and unprofitable an experience that it is no easy matter to speak of it in anything but discouraging terms. The Budapest experiment, however, has certainly shown that under favorable conditions and with careful construction the plan works very successfully. A glance at the cuts in the paper will show, however, that the construction is most solid and thorough and that every precaution has been taken to avoid the leakage that has caused the failure of so many similar attempts. The slotted conduit can unquestionably be made thoroughly operative, if—and this is a very important word—the situation is favorable. There are many city streets through which such a conduit could be laid to-day with the best results, but there are other streets, lying close alongside them oftentimes, where the difficulties of drainage would be almost insurmountable. One interesting feature of the Siemens motor truck is the use of sprocket wheels and chains in lieu of gearing. This particular device has not had fair play yet in electric traction; people have been afraid of it, just as in the early days of safety bicycles the same arrangement was regarded as thoroughly unreliable. But the bicycle sprocket chain very seldom breaks nowadays, and it is only fair to assume that an equal improvement can be made in the apparatus on a larger scale. Though it may never altogether replace spur gearing, the sprocket chain can certainly find a useful application in the transmission of power from one axle to another where a single motor is employed, as ought most generally to be the case.

Cars and Car Trucks. THE tendency is toward the use of long and capacious cars, particularly of the double truck and radial truck varieties. In the introduction of electric power changes were found necessary in the existing car trucks. So long as the only weight to be supported was the body of the car and its contents smooth running was comparatively easy, but when upon each axle was placed a motor weighing in the vicinity of two tons, with a considerable portion of its weight resting directly on the axle, it became a decidedly difficult matter to secure the requisite steadiness of motion. A heavy electric car pounds the track quite severely, and in the earlier days when horse railroads with their light rails were transformed into electric roads derailments were exasperatingly frequent. In addition to this fact to-day electric cars are run at speeds that were not contemplated two or three years ago. Two directions have been taken in the way of improvement, one toward unusually flexible four-wheel trucks with special devices for cushioning all portions of the running gear. An excellent example of this construction is described elsewhere in the current issue. The other line of progress is toward cars with bogie trucks, or with the so-called radial truck. Both these devices give much increased steadiness of motion and where high speeds are attempted furnish excellent security against running off the track. With all the advantages of these elaborate cars, however, go certain disadvantages that are worth mentioning. In the first place they do not mount grades nearly as readily as the four-wheel cars, for the reason that only a portion of the weight rests on the driving wheels. There are ways out of this difficulty, the most obvious of them being, perhaps, driving both axles on either truck by a single motor, joining them by connecting rods or by a sprocket chain; or the so-called maximum traction type of truck can be used, in which most of the weight rests on a single pair of wheels. But aside from this the long cars are very heavy and take an abnormally large amount of power. During the crowded hours of traffic they are enormously convenient on account of large capacity and easy running, but there are very many cases where it is undesirable to employ them on account of the great waste of power when operated with a comparatively light load. This word of warning therefore is not inappropriate: Use the long car whenever you can keep it reasonably well filled, or where you must run at high speed; be cautious, however, if your load is likely to be light.

Unusual Methods of Electric Traction. THERE have been springing up recently a considerable number of systems for electric street car use which are worth thinking about although they have not come into anything like practical service. The trolley wire is the most obvious and common method of supplying power to a moving car, and next to it perhaps the storage battery and the conduit. But the trolley wire offends the æsthetic sense of a portion of the community and scares, quite unnecessarily, another portion, while the conduit has a choice collection of faults of its own, some of them very difficult to avoid. Consequently there has arisen a large variety of modified plans of rail supply and closed conduits, some of them marvelously ingenious and others extraordinarily impractical. The favorite arrangement has been dividing the line into sections of supply conductor formed either by a third rail or by one or both of the working rails, and then switching the current automatically upon the section immediately under the car. The Wheless, Lineff, Pollock, Gordon and other systems belong to this type, and all of them work fairly well in an experimental way. To these unusual plans may be added that of using the rails as conductors and supplying the current at so low a voltage as neither to cause perceptible shocks nor serious leakage. In this case it is interesting to speculate on the probable amount of current that will be required in surmounting a considerable grade and the probability of transmitting it successfully to the wheels during a muddy season. We may add to these two or three other recent proposals, as, for example, a continuous field magnet located in the conduit and an armature carried on the car, also an alternating current system with the primary in the conduit and the secondary on the car. For further instances of remarkable inventive efforts the reader need only follow our weekly patent record, which has been the graveyard of untold numbers of them. The whole class is interesting as an example of the diversified devices that human ingenuity can suggest, and out of them all it is not too much to hope for something reasonably practical, perhaps even successful. If any of our readers are tempted to look carefully into the merits of any of them we would suggest that he should sit calmly down with a pencil and attempt to work out the circuits for a crossing between a double track road with a single branch at a side street, and another double track road with a corresponding branch, where the two companies refuse to take each other's current. After the solution of this little difficulty in practical form the reader's mind will probably be in a condition that will enable him to grasp the other working details with comparative readiness.

Latest Foreign Electrical News.

(By Cable from Our Own Correspondent.)

London, Oct. 19, 1891.—At a meeting of those concerned in the electric lighting of the city of London, on Thursday last, the chairman, Sir David Salomons, stated that 200 applications, amounting in the aggregate to 40,000 lights, had already been received, and that it was expected to commence private lighting in January, 1892. The system adopted is the erection of 10,000 light transformer sub-stations feeding a 100-volt network.

A recent fire in the Bournemouth telephone exchange is reported as being caused by a cross in an electric lighting main.

An important move in the matter of telephony has been made by the Austrian government, which has decided to purchase at the end of the year 1892 the entire business of the Telephone Company of Austria.

The deputation of the Glasgow municipality engaged in looking into the question of tramway systems, as mentioned in a previous despatch, visited Frankfort and has sent in a report in favor of the adoption of either mechanical haulage by cable or electric tramways; in the case of using the latter they prefer the accumulator method.

The Manchester ship canal is about to have an electric launch service established on it by one of the well known English companies.

On Monday last a fatal accident occurred at the Lauffen power station on the Frankfort-Lauffen line. The victim was an employé of the station who entered the transformer house and probably touched a high-tension conductor. The accident was due to his direct disobedience of written instructions expressly forbidding the very thing he did.

Electrical Transmission of Power from Niagara to Chicago.

[*From our Special Correspondent.*]

Frankfort, Oct. 7, 1891.—Mr. Hornsby, assistant to Professor Barrett in the electrical department of the World's Fair, has been looking up electrical work at Frankfort, and in a conversation with Mr. Dobrowolsky, inventor and designer of the apparatus used in the Lauffen-Frankfort electrical transmission plant, the question of transmitting power from Niagara to Chicago was brought up by Mr. Hornsby. Mr. Dobrowotsky stated that he would be willing to bid on a contract to transmit either 1,000 or 5,000 h. p. from Niagara to Chicago, if the opportunity were ever afforded. The distance being over 700 kilometres (or about 500 miles) the potential to be used would be between 40,000 and 50,000 volts. An efficiency of 60 to 75 per cent. could be obtained without difficulty; *i. e.*, of 5,000 h. p., generated at Niagara, 3,000 h. p. could be utilized at Chicago.

NEW BOOK.

Electricity and Magnetism. Translated from the French of Amédée Guillemin. Revised and edited by Prof. S. P. Thompson. Pp. 976. 600 ills. London: Macmillan & Co., 1891. Price, $8.

This treatise, for in size it rises to the dignity of that name, is of a characteristically popular character. The editor's statement that it is intended for the drawing room rather than for the desk of the student is, however, not quite correct, for there is much information in it that is not contained in books that the student is likely to have before him, and the treatment implies rather more electrical knowledge than is likely to be found straying about the drawing room. It is a very convenient volume to have in the library, however, whether for reading or for study, because it contains a great amount of miscellaneous information which otherwise would have to be obtained by a search through a considerable number of volumes, and besides, the style is such that the book is really more than usually interesting reading, a compliment that cannot be paid to the majority of electrical works. The work is beautifully gotten up, and the illustrations are unusually good.

A Double-Deck Electric Car.

There has recently been incorporated in Chicago a company composed of well known capitalists of that city, for the purpose of manufacturing a new electric street car, which will be known as the Pullman centre vestibule street car.

Recently a practical demonstration of the new invention was given at Pullman, Ill., before a number of business men and others interested, from Chicago, who were present by special invitation of George M. Pullman.

The car is the joint invention of E. C. Sessions, of Oakland, Cal., and C. L. Pullman. The one exhibited at the test weighs 28,000 pounds and cost $3,500. It is a "double-decker," designed to double the carrying capacity of street railways, as well as adding to the comfort of passengers. In general appearance it is said to resemble the double-decked vehicles in use in London and Paris, being 32 feet ong, 7 feet and 4 inches wide, with a height of 14 feet 9½ inches. A seating capacity for 40 passengers on each deck is provided for, the car body being arranged so that passengers may enter at the centre of either side, spiral stairways leading to the upper deck. Two compartments comprise the lower car body, each 12 feet long, with circular ends, the seats being arranged around the ends and sides. A canopy covers the top.

The car exhibited was operated by the trolley system, Westinghouse motors being used, of 25 horse power. It is equipped with electric chandeliers and electric heaters in each compartment, the finish being in mahogany, with a handsomely painted exterior. It rests on two trucks of special design, having double brake attachments and a friction brake. The interior conveniences introduced are electric signal bells for stopping and an electric diagram showing vacant seats. The services of three employés are necessary in its operation. It is thought that on account of its novel features and its great carrying capacity it will be readily adopted, especially by roads where traffic is exceedingly heavy, as each car will carry 250 passengers, and that it practically solves the problem of rapid transit traffic.

Electric Railroading in the Current Year.

Just before the convention of the American Street Railway Association at Buffalo a year ago, The Electrical World sent out a circular to electric street railway companies asking for information on various points, and so useful was the result that a similar paper was sent out about a month ago for the purpose of obtaining certain facts regarding the operation of electric roads that might prove useful to street railway men. The questions asked this year were somewhat different from the previous list, being designed especially to cover two points—the use of improved motors, and the amount of repairing now necessary in the motor equipment. The following questions were asked and a large number of replies were received, for which we have to thank the courtesy of our street railway friends:

1. How many motor cars have you? 2. How many motors in use on them and of what system? 3. How many miles of track have you? 4. How many miles each per day do your cars run? 5. What is your station equipment-number, capacity and make of dynamos, engines and boilers? 6. What are your station expenses for power per day (fuel, oil, engineer, firemen, etc.)? 7. Have you tried track or power brakes; if so, of what kind and with what result? 8. Have you any single reduction gear motors of any kind in use; if so, of what make, and how do you like them? 9 (a). Do they start well on grades? (b.) Do they heat as much or more than the old motors? (c.) Do they take as much or more current? (d.) Are they able to perform your heaviest service in a satisfactory manner? 10. How long has your road been operated? 11. During the year ending Sept. 1, 1891, how many armatures have you replaced or rewound? 12. How many field coils? 13. How many rheostats (or switch boxes) have been disabled during the same time? 14. How many gear wheels? 15. What has been the aggregate cost of repairs to the car equipment?

Before going into a detailed discussion of the replies received, it may be well to glance at the general results of the past season in the development of electric traction. No being, not possessed of the attributes of omniscience and omnipotence, knows at the present moment just how many electric street railways there are in operation. The Electrical World has from time to time published estimates derived from various sources, but the discrepancies between the different reports are very great and probably all are over-estimates; at least the list used in sending out the circulars contained a number of roads which are not under construction or even under contract. Three hundred and fifty is probably not very far from the correct number of electric roads to-day, including those actually under construction. The mileage of electric roads is now probably in the vicinity of 3,000, and the number of cars approximately 6,500. Since the last convention there have been profound changes in electric railway apparatus. It has been realized for a couple of years, and had been pointed out from time to time in The Electrical World during that period, that a double reduction of speed of the motors by gearing was undesirable and that a slow speed motor must be the motor of the future, gearless if possible, at all events with but a single gear reduction. At the last Street Railway Convention the first of the really slow speed motors—that brought out by the Wenstrom company—was exhibited. During the early months of 1891 all the principal manufacturers of electric street railway motors brought out single reduction machines, and two of them—the Westinghouse and Short companies—devised gearless motors, which have not yet, however, been much more than experimentally worked. The Eickemeyer gearless motor should also be mentioned in this connection, although it has not been exploited so vigorously as the others. It was no small task to produce a durable and efficient railway motor possessed of an armature speed low enough to permit a single gear reduction. The older motors were reasonably efficient electrically, but the armature speed was in the vicinity of 1,000 revolutions per minute. With the standard sizes of wheels in use on street cars this armature speed had to be brought down to about one-third its usual value to permit of a single gear reduction, and to one-tenth to allow gearless machines mounted directly on the axle to be used at ordinary speeds. To accomplish either of these feats, retaining at the same time a tolerable efficiency, has been no easy matter. To produce the necessary turning effort on the axle a slow speed motor armature must be constructed so as to have a torque very much greater, and its windings much more powerful than in the case of the old armatures. This increased torque has to be obtained by increasing the induction through the magnets, the number of armature turns, and the current through the armature; sufficient increase in any one of these will answer the purpose but practically all three are necessarily varied, for in the effort to build a light weight motor even the double reduction gear machines had the iron worked up practically to saturation, a large number of turns of wire on the armature, and a considerable current flowing through it. A certain gain can be made by constructing multipolar machines, thus making the armature wire in part do double service, but the help is not so great as might at first sight appear. A great deal of ingenuity was spent in combining the three factors of the torque in such a way as to obtain the best results. The multipolar construction has been rather a favorite, and the changes have been in the direction mainly of more powerful armatures wound with more turns of wire and with coarser wire. So far as the single reduction gear motors are concerned the problem has been solved with a fair degree of success, in fact only one of those brought out within the year has proved so unsatisfactory as not to be adopted to any extent. When it came, however, to reducing the speed of the armature not to one-third of its former value but to one-tenth, the difficulties were enormously enhanced, and in neither of the designs brought out has it been thoroughly evident whence the enormous torque required can come. Both forms are reported to do well in comparatively light work, but what would be the results when tried on the same service now exacted of the standard motors it is impossible at present writing to say, as neither type has yet been adopted widely enough to permit any judgments based on everyday experience to be made. The single reduction gear motors have in general proved an unqualified success, thus amply justifying the predictions of the result that have at various times been made. As regards the efficiency of these new types of machines, appearances indicate that rather more is saved in the gearing than is lost in purely electrical efficiency, so that the total result is rather better than with the old motors. The general adoption of the Gramme type of armature for this work has decreased armature repairs, and accompanying improvements in design have probably raised the mean working efficiency at least five per cent.: all this means better and more economical service. As regards power station practice the indications are that it has improved. The tendency has been to the use of larger dynamos, large and more economical compound or triple expansion engines, and a better proportioning of the plant to the average power required. One marked change has taken place in car equipments; the double truck car exhibited and very much commended at the last convention has proved one of the forerunners of a considerable number of long electric cars provided with bogie trucks or with the excellent radial truck gear that has been recently introduced. Such cars have been rendered necessary by the requirements of electric service. So long as the speeds employed were comparatively low ordinary street car trucks or special forms designed better to support the motors proved quite sufficient for all requirements; as soon, however, as it became necessary to increase the speed considerably a fixed wheel base, comparatively rigid in spite of every effort at flexibility, becomes unsuited to the work, and in addition it is sometimes convenient to use large and very capacious cars. As a result of this a large number of companies are now running, more or less, the long electric cars; they are most serviceable on the larger roads, where they will seldom have to be run lightly loaded. Such cars have to a considerable extent replaced the regular employment of trail cars, although these are most convenient for handling an occasional increase in traffic.

Coming now to the reports received in response to our inquiries, the car mileage properly comes up for consideration. The average is not greatly increased over the figure 101 given by the average of last year's reports; the maximum car mileage, however, is noticeably high. The largest mileage reported was from a small Thomson-Houston road that had been in operation about three months. The president of the company stated that the cars made 175 miles a day, a figure a good deal in excess of the maximum found in last year's reports. Two other roads, a Sprague-Edison and a Westinghouse, both of small size, reported a daily car mileage of 160, while a considerable number reported from 125 to 150; from this the figures ranged down to 46 as the average day's run.

Comparatively speaking, so few roads, even now, are employing single reduction motors that the replies to the questions concerning the operation of these were not as extended as might have been wished. Reports, however, were received from one or more representatives of each of the following systems: Edison, Thomson-Houston, Wightman, Sperry, Westinghouse, Sieberling and Baxter. Every road reports entire success. In each case it is stated that the motors start well on grades (in one case noted as seven and a half per cent.), do not heat much, seem to take about the same current as the old machines unless possibly a little more in starting, and can perform the heaviest service of the road in a thoroughly satisfactory manner. The

reports are uniformly of the most encouraging character, and one or two superintendents wrote in detail to say that they were especially pleased with the performance of the new type of machine. One reports that the single reduction gear machines are working regularly over grades as high as eight per cent., and sharp curves on inclines only a trifle less severe. Another road is in the habit of taking two trailers up a six and a half per cent. grade with a pair of 20-h. p. motors on the motor car. All this ought to be exceedingly satisfactory both to the street railway men and to the manufacturers of the machines, and leaves no question as to the success of the single reduction motor, which is bound to drive out the older types very rapidly.

The reports on repairs were of a rather singular character; they were surprisingly good, some of them almost too good, in fact. It is certainly very remarkable, for instance, to have a road operating 10 or 12 cars report no armature or field coils replaced or rewound, and no other apparatus disabled during an entire year's operation. On the other hand, the average result of the replies may not be far from correct, for one disgusted street car man reported the cost of repairs on the car equipments as probably reaching $1,000 per car per year. It is very difficult to get at the true cost of necessary repairs on motor equipments, because those who have suffered do not usually care to disclose the full extent of the injury. The reports received indicate, as might have been predicted, that the principal mortality is in armatures, at least three of these being seriously damaged to one field coil, rheostat or switch box, and the general tenor of the present reports seems to show that as regards armatures there has been perceptible improvement within the last year. Next year, thanks to the single reduction motors with their big Gramme armatures, the results will unquestionably be even more favorable than at present. The same is true in the matter of gears, for the open gear of the old double reduction motors was, and is, particularly subject to wear and breakage owing to multiplicity of wheels and to free access of grit and dirt of every description. The later motors with single gears run in oil should, and undoubtedly will, show a very much lessened wear and tear and vastly decreased repair bills.

As regards systems other than the overhead lines, there is very little to say at present. A single storage battery road has been put into operation during the year, and that one is stated to have given very satisfactory results, although no detailed report was sent in. Several other storage battery roads are threatened, together with divers conduit roads of sundry descriptions, but none of them has materialized sufficiently to be given a place here. Altogether the past year has been fruitful in improvements in electric traction, and there are more to come. The directions from which they must be expected are the more general use of the single reduction motor, the improvement of the gearless machines so as to be thoroughly available—at least for light service—the increased use of long and capacious cars on large roads, the displacement of wasteful engines by more economical types of a size better suited to the work, and finally the invention of that ideal piece of apparatus for which every pious street railway man is devoutly praying—a lightning arrester that will effectively protect his dynamos.

Electrical Practice in Europe as Seen by an American.—VII.

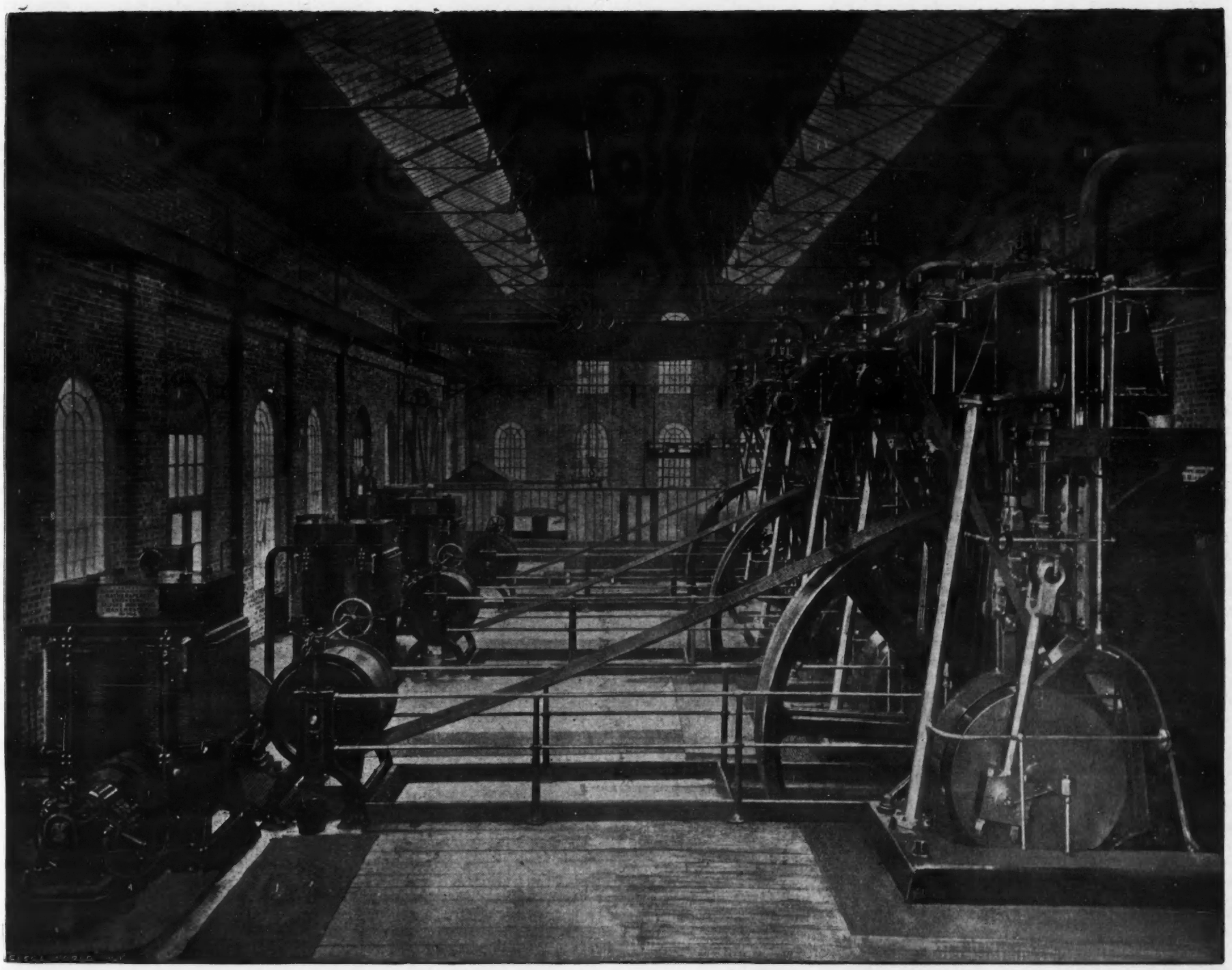
BY CARL HERING.

CITY AND SOUTH LONDON UNDERGROUND ELECTRIC RAILROAD.

During a recent visit to London the writer intended to examine the "City and South London R. R.," with the view of giving a technical description of it here; it was, however, quite impossible to get reliable technical data and detailed descriptions, and for this reason the following short description and criticism has to be limited to such parts as could be seen from personal inspection, and to data obtained directly and indirectly from various sources. The officials were very courteous to the writer, but evaded or declined to answer questions regarding details. We were therefore left to conjecture.

This railroad is the first and at present the only underground electrical railroad running through a large city for furnishing rapid transit between points in the city. The road as shown by the plan starts at Monument station, not far from London Bridge, which is near the busiest part of London, crosses under the River Thames, and continues in a slightly winding course under the streets, entirely through built up portions of the city, to the district called Stockwell. Its course forms to a certain extent a sort of diameter to the circular course of the local steam railroad lines. The tunnel itself consists of two lines of circular subways, one for the up and one for the down trains, sometimes located side by side and sometimes over each other. The tunnels are made of a circular steel cylinder 10 feet 6 inches in diameter inside of the flanges and formed of rings of cast iron segments bolted together at their internal flanges. The rings are 1 foot 7 inches long. The circular joints are made with tarred rope and cement, and the longitudinal joints with thin strips of pine wood. The surfaces are not planed, but remain just as they came from the foundry. The tunnels pass for the most part through clay, and partly through sand and gravel. The tunnel was driven by hydraulic cutters,* the whole being done without the slightest interference with the traffic along any of the thoroughfares under which it was being built, a matter of great importance to the residents of the city. The line of the two tunnels as they pass under the River Thames is not by by any means a level one.

The tunnels are over each other at various places, partly so as to avoid encroaching on private property, and partly so that at the stations one elevator may be used for both lines, instead of two, one on each side of the street. Another reason is that it is claimed that the cost of excavating and lining is less for two small tunnels than for one large one. The greatest up grade is 1 in 30, at the river, but otherwise the road is practically level. The north end of the road, which is near the river, is about 80 to 90 feet below the street, but the average depth is much less than this, though it is said to be deep enough to pass under all sewers and pipes.



INTERIOR VIEW OF THE POWER STATION OF THE CITY AND SOUTH LONDON UNDERGROUND RAILROAD.

At each station there is a large hydraulic elevator, the power for which is supplied by pipes from the main power station, which is at the Stockwell end. Why such a cumbersome method was used instead of electricity is difficult to see; perhaps it was because the original intention was to run the trains by cable; perhaps also because the promoters were civil and not electrical engineers, who were not sufficiently well posted on the advantages of electrical elevators, and therefore resorted to the older and more primitive method. If electricity can be relied upon to run the trains, why should it be less reliable for the elevators; should the trains stop by failure of the line, what is the use of the elevators, as there is a staircase next to each of them? To

*For a detailed description see *Engineer*, London, June 7, 1889, p. 477, third column.

transmit hydraulic power through such distances must surely be more expensive and less reliable than to transmit electric power. We are informed that certain bad stoppages, which are made so much of by the opposition parties, have been due to the failure of the hydraulic transmission, which fact speaks for itself. The hydraulic plant at the generating station forms no small part of the total plant. As to its efficiency we have no data, but it certainly cannot be as good as that of electricity would be. It would seem that the matter of transmission of power ought in a well regulated plant be put into the hands of electrical rather than civil engineers.

To an American used to smoothly running railroad cars the road bed appears very rough, as noticed from the violent shaking of the cars, and this must affect materially the consumption of power and must strain the framework and joints of the tunnel. The air in the tunnel is cool, but has a decided musty smell like that of a damp deserted cellar. The cars are closed and there are no windows, so the strong draught on the outside of the train is not felt much in the cars. For long rides, however, this damp smell would be very objectionable, which could probably be overcome by building the tunnels so that they are drier. There is said to be only a small quantity of water leaking into the tunnels, which is pumped out daily by means of hydraulic injectors placed at the low points and operated from the high pressure water pipes which operate the elevators. The underground stations are lined with white glazed brick and appear to be dry and well ventilated; they are lighted by gas, strange to say. A train consists of one locomotive and three cars for about 30 to 35 passengers each, or about 100 to a train. They are run regularly at 4½ minute intervals, making a maximum carrying capacity of 1,330 passengers per hour. There are three trains running each way at one time about one mile apart, and one at each end station, making a total of eight trains, six of which are running. The maximum speed is said to be 25 miles and the mean 20. The average speed, including stops, is said to be 15 miles per hour. The total length of the line is about 3½ miles. The cars are nearly circular in section, have two rows of longitudinal side seats and entrances at the ends; the entrances are closed and locked while the train is in motion. The cars communicate, and in case of an accident completely stopping the train, the passengers could walk out through the tunnel, provided the doors which are locked and bolted from the outside can be forced open by the imprisoned passengers. The cars are calculated for 30 cubic feet of capacity per passenger (20 cubic feet is the usual number required on English railroads). The cars are very inadequately lighted by incandescent lights, five in series on the 500-volt mains supplying the motor. They are naturally very unsteady, which is very annoying; all grades and changes of speed are very noticeable in the brightness of the lights. Oil lamps are used as reserves, and contrast very favorably with their poor competitor.

The locomotive has two axles, each with two wheels. Each axle carries a Gramme ring armature secured on it, and forms, therefore, a gearless motor. The magnets, one set for each armature, are formed of two large massive cores and a yoke piece, which extend from the shaft upward, in an inclined position toward the middle of the car; their lower end rests on bearings on the axles and the upper end is suspended by means of a bolt; each axle, therefore, has four bearings, two for the car and two for the magnets. Each motor is said to have a maximum output of about 50 h. p., making 100 h. p. per train; when the train is fully loaded with 100 passengers, this would make about 1 h. p. per passenger, which seems very high; it is likely, however, that the normal power used is far below this figure. Each motor is said to be capable of running the train alone, though slowly, in case of an accident to the other motor, which case has, it is said, happened more than once. The reserve motor power is, therefore, 50 per cent. of the maximum, or 100 per cent. of the normal, if 50 h. p. can be taken as the normal. Another statement made to the writer by the attendant at the generating station was that each motor took about 75 ampères, which at 450 volts and 80 per cent. efficiency represents 36 h. p. at the wheels per motor or 72 per car. There are two sets of carbon brushes held in tangential holders; the whole space surrounding the brushes and commutator is dust proof and is covered with a thick plate of glass forming part of the floor of the locomotive, and thus permitting the engineer to see the action of the brushes all the time, a commendable feature. The brakes used are the usual air brakes; a supply of compressed air at 80 pounds pressure is carried in iron cylinders sufficient for one return trip. They claim that air brakes are much simpler than electrical brakes; beside this, the brakes might have to be used quickly and unexpectedly in case the current was interrupted, which itself may be sufficient reason for not using electrical brakes.

Regarding the electrical details and data of the locomotive and the circuits no information could be obtained, although application was made in turn to the officials, the engineers and contractors (Mather & Platt). But as far as could be seen there was nothing unusual of any importance. Judging from this and from other things that were noticed, we surmise that the electrical part is not altogether satisfactory; in another similar road there would probably be changes made, as indeed is quite natural, because the present road is to a certain extent, at least, an experimental road, and it would have been surprising if this first road had left nothing to be improved upon. It would be quite interesting, however, for engineers to know what not to do. One thing we noticed was quite significant; in the repair shops there was seen a large scrap heap of copper wire, which, from its shape and general appearance, evidently came from burnt-out armature coils. An attendant at the repair shop remarked that they had become quite experienced armature winders, a remark which is significant, as the road had been running only seven months. The burning out of these armatures may have been due to the fact that they were originally poorly made, and perhaps the rewinding of them has been more satisfactory; at all events, the insulation of the wires of a gearless armature (that is one whose shaft is the axle of the wheels of the car) is strained very badly, particularly when the roadbed is very rough, as in this case. No springs can relieve it of the direct blows which the armature gets when the track is not perfectly even. Besides this the strong current required at starting is far greater and acts for a longer time than in a geared motor. This is readily noticed from the variable brightness of the lamps in the car, which in this case can almost be said to be a crude ampère meter.

The locomotive receives its current from a single rail laid on the sleepers near one of the tracks; the tracks themselves formed the return lead. This current rail was made of an alloy of steel (the composition is said to be a secret) which is at the same time very hard and a good conductor. The rail has a rectangular section, and lies almost directly on the sleepers. The insulation appears to be quite thin and without much surface; it is likely, therefore, to cause trouble by leakage in such a damp place. Why such a good opportunity was lost to place it on the side of the tunnel is not apparent; this would have avoided almost completely the difficulties of insulation. The contact from the locomotive to this rail was made by a very crude arrangement consisting of a heavy cast iron tongue which slid on the top of the rail and was held by a loosely fitting hinge; there was no provision for shunting the poor contact at this loose hinge, though it might easily have been done. There were three of these tongues on each locomotive; being curved, they work equally well for both directions of motion. The contact rail was in sections supplied by independent leads, presumably the same as usual.

There was only one generating station, which was located at the Stockwell end, presumably because ground was cheaper there than in the middle of the road, the space occupied by this station and the adjoining repair shop being quite large. It included an inclined plane tunnel leading down to the subway for raising the cars for repairs; this was operated by a cable and a windlass. The main part of the interior of this station is shown in the adjoining illustration. There are three dynamos of 500 volts and about 500 ampères each, having a speed of 500 revolutions. There is an engine of 375 h. p. for each; they are non-condensing, and govern very poorly. The dynamos are compound wound, and contain switches on their yoke pieces, by which the compound winding on each limb of the magnets may be cut out. There is no equalizing arrangement between the compound windings. Link belts and idle pulleys are used. The belts stretch very materially when carrying a load. The dynamos are cooled artificially by air blasts supplied from air pumps. The lubrication is by means of a milky white mixture of castor oil and water.

The switchboard for this station is quite simple. The dynamos are connected separately to it, and can be variously connected to the different sections of the road. It includes an ampère meter reading to five ampères, by means of which the insulation is measured every morning before starting with a 500-volt current. We understand that a few ampères leakage is not considered to be too much. At 2½ ampères the insulation resistance would be but 200 ohms, which surely is not good. The cost of this wasted energy (.6 h. p. per ampère of leakage) is probably not of as much importance as the electrolytic corrosion of the rails and destruction of the insulation which probably accompany it. The switchboard furthermore contains automatic cut-outs, which for abnormal currents switch a resistance into the circuit; if after that the current is still too great it opens the circuit entirely; if the latter does not take place the engineer in charge cuts out the resistance again.

Strange to say there is no telephonic communication between the generating station and the way stations. Instead of this there is a needle telegraph system. The reason given for this otherwise poor substitute is that all communications must be made in writing and filed at the office, which naturally has its advantages.

Inquiry at the main telegraph office of London showed that there were no serious disturbances of the telegraph lines by these powerful earth return currents; but they are said to materially affect the magnetic observations at the Greenwich Observatory, which is about five miles from this railroad.

The interruptions in the running of this railroad are said to have been due chiefly to the hydraulic pipes and to short circuiting and burning out of the armatures. But these interruptions are said not to have been of a serious nature. The former could readily have been avoided by using electric instead of hydraulic transmission of power. For the latter electricians will soon find a remedy, be it by more careful insulation or by using a geared motor which is supported on springs to dampen the concussions. Much is made by opposition parties of interruptions which have occurred, but this is presumably exaggerated. We surmise, however, that there was, perhaps, too much civil engineering and too little electric engineering in some features of the road, and we are led to believe from this that the latter engineers, who were mere contractors under the former, were not altogether responsible for some of the unsatisfactory features.

The road was opened in December, 1890. The gross earnings are said to be £700 (about $3,500) per week. The civil engineer of the road was Mr. J. H. Greathead (who is one of the consulting engineers of the Hudson River tunnels), and Sir John Fowler consulting engineer. Messrs. Mather & Platt were the contractors for the electrical plant, under the direction of the civil engineers.

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Chronological History of Electricity, Galvanism, Magnetism and the Telegraph, from B. C. 2637 to A. D. 1888.—Part I.*

BY P. F. MOTTELAY.

A. D. 1780.——Spallanzani (Lazaro), celebrated Italian naturalist, to whom the French Republic vainly offered the professorship of natural history at the Paris *Jardin des Plantes*, and who has been already particularly alluded to in connection with John Walsh, at A. D. 1773, writes a second treatise upon the operations of Charles Bonnet, of Geneva, as regards the effects of electricity upon the nerves and muscles. He is also the author of works upon electrical fishes as well as upon meteors, etc., which will be found detailed in vol. VII. of the "Biographie Médicale," as well as at page 246, vol. XLIII., of the "Biographie Universelle."

See Alibert's Eloge in vol. III. of the "Mém. de la Soc. Médicale d'Emulation;" "Catal. Roy. Soc. Sc. Papers," vol. V., p. 767; "Opus. Scelti," vol. VII., pp. 340, 361; VIII., p. 3; XIV., pp. 145, 296; Brognatelli, "Ann. di chimica" for 1793 and 1795; "Mem. Soc. Ital.," vols. II., p. 11, IV., p. 476.

A. D. 1781.——Lavoisier (Antoine Laurent), an eminent French natural philosopher, the chief founder of modern chemistry as well as of the system of chemical nomenclature which prevailed exclusively during the early part of the nineteenth century and ended in the expulsion of the phlogistic theory, demonstrates by several experiments made in conjunction with Volta and Laplace that electricity is developed when solid or fluid bodies pass into the gaseous state. Sir David Brewster says that the bodies which were to be evaporated or dissolved were placed upon an insulating stand and were made to communicate by a chain or wire with a Cavallo electrometer, or with Volta's condenser, when it was suspected that the electricity increased gradually. When sulphuric acid, diluted with three parts of water, was poured upon iron filings, inflammable air was disengaged with a brisk effervescence; and, at the end of a few minutes, the condenser was so highly charged as to yield a strong spark of negative electricity. Similar results were obtained when charcoal was burnt on a chafing dish, or when fixed air or nitrous gas was generated from powdered chalk by means of the sulphuric and nitrous acids.

The phlogistic theory alluded to above, which was so named by George Ernest Stahl in 1697 after J. J. Beccher had pointed out its principle in 1669, had for its most energetic defender Mr. J. C. De La Méthérie, editor of the *Journal de Physique*, who is entered at A. D. 1785, and it was in order to offset the influence which this gave him that the antiphlogistians established the *Annales de Chimie*, so frequently mentioned in these pages.

See George Adam's "Lectures on Nat. and Exp. Philosophy," London 1799, vol. I., pp. 575-587, wherein Lavoisier's system is computed by the German chemist Wieglib, whose views are indorsed by Mr. Green, while for Stahl and Beccher, refer to Sir H. Davy, "Bakerian Lectures," London, 1840, p. 102 (note) and to Thomson's "Hist. of Roy. Soc.," London 1812, p. 467. See also J. M. G. Beseke "Ueber elementärfeuer . . . ," Leipsic 1786; G. A. Kohlreif, "Sollte die elektricität . . . ," Weimar 1787; Lavoisier and Laplace, in the "Mém. d l'Acad. Roy. des Sciences" for 1781, p. 292; Lavoisier's "Opuscules . . ." 1774 and his "Rapport . . . mag. animal." Paris 1784; Dr. Thomas Thomson, "Hist. Roy. Soc.," pp. 479-486; Herschel's Nat. Phil. concerning the third age of chemistry; Grégoire, "Dict. d'hist., etc." p. 1,171; Miller's "Hist. Phil. Illus.," London 1849, vol. IV., p. 332, note.

Japanese Copper Mines.

According to a recent official report the export of copper from Yokohama showed a large increase last year. It amounted to 11,409 tons, as against 3,255 tons in 1889 and 4,672 tons in 1888. This increase is mainly attributable to the fact that a large part of the production of the principal mines had been held over from the previous year. Production has, however, also increased. The copper export from Yokohama consists of Furukawa ingots from the Ashiwo Mines, refined in Tokio; slabs from the Kusagurai Segawa, Nosawa, Washinosu, Kodama, and Mitsusawa mines. The production of the Ashiwo Mines is now estimated at 7,500 tons per annum; the works there have been extended, and the facilities of transport have also been improved. The quantity of copper exported from there last year was equal to 93 per cent. of the whole export of the port.

* Continued from The Electrical World, Oct. 17, 1891.

The Elements of Practical Electricity.*

BY DR. LOUIS BELL.

THE POLES OF A MAGNET.

If you test, by sprinkling with iron filings, either a horseshoe electromagnet or a piece of straight magnetized wire, you will appreciate something of what is meant by a magnetic pole, for you will find, as indeed you probably have already found, that the filings do not cling uniformly over the magnet, but are bunched at and near its two ends. It seems almost as if the power of the magnet were concentrated at these two points, which are called the poles. You might at first thought suppose that they were a necessary part of every magnet, that is, that magnetization could not exist without producing these localized effects. If, however, taking a horseshoe electromagnet, you place a soft piece of iron across its two poles, you will find that there is much less tendency for filings to cling at particular points than there was before; in fact, the soft iron seems to occupy most of the strength of the magnet, and in the combination poles are but weakly developed, although there is plenty of magnetism, as you can readily find by trying to pull off the iron. As a matter of fact these so-called poles are really only a single and comparatively unimportant manifestation of magnetism. The fundamental fact is that the bar becomes strongly magnetized, while evidence of this may or may not appear prominently in any particular part of it. You can study this particular side of magnetization very nicely by constructing a ring maengt such as is shown in Fig. 15. Get a blacksmith to weld you a ring of half-inch bar iron. This ring should have a diameter of say 2½ or 3 inches. Cut it in halves with a hack saw and then file the joints smooth and flat so that the two halves of the ring fit nicely together. Wind one half of the ring with wire; as shown, then, on sending a current through this coil its iron core becomes strongly magnetic, and poles are very manifest at its ends. If, however, you fit the other half of the ring carefully into position you will find that it is very strongly attracted, so that quite a sharp pull is necessary to detach it, but the poles have disappeared, and if the joint be carefully made there is hardly any tendency on the part of the iron filings to cling about the magnet anywhere; a few may remain in the vicinity of the joint, but the poles as such are gone, though the presence of magnetism is evident enough if you attempt to separate the halves of the ring. Now, on breaking the current and then reversing its direction you will find that the conditions are practically unchanged, and in either case not only does the ring fail to attract iron filings in any quantity, but its effect on a compass needle shows the absence of very conspicuous poles; in fact, it behaves very much like any other ring of soft iron except when you try to pull the halves apart. Now, separating the halves, put a piece of writing paper over the joints, and replace the two portions to form a continuous ring again, then passing the current through the magnetizing coil you will find that the attraction between the halves is somewhat less than before the paper was introduced in the joint; in fact, it is likely to be considerably less; the exact amount of difference you can test by holding one half of the ring firmly down against a table, hooking a spring balance into the other half, and then pulling gradually until they come apart, keeping your eye on the index of the balance to note the pull in pounds required. Try this experiment with and without the paper interposed in the joints and you will realize the effect of separating the two parts of the ring magnet, even by a very small amount. Furthermore, when the paper has been introduced you will find there is much more tendency for iron filings to cling about the joint; in other words, the poles begin to reappear. If a piece of cardboard be substituted for the paper this effect will be still more striking. The cause of this peculiar behavior is that a pole, that is localized magnetism, depends on the relation of the iron magnetized to things about it. If you connect the poles by any magnetic material, such as iron, they straightway nearly disappear, while if you were to magnetize a closed ring, and then cut a piece out of it, poles would appear where the segment of iron you removed was replaced by air; indeed the poles only exist where magnetic effects shift as it were from one material into another,—as from iron into air or even into a different kind of iron. This latter fact you can show by bending half inch steel into a half ring and fitting it to the soft iron half ring which carries the magnetizing coil, when on passing the current poles will be much more evident at the joints than was the case with the original iron ring, rovided the joints are equally good in either case. You can understand this, perhaps, by thinking of the magnetic force, whatever it is, as belonging not only in the iron but in the surrounding air, as you have already discovered by the effect of the magnet on a distant compass needle. Wherever, then, this magnetic force passes from one material into another of different magnetic qualities, there will be what is commonly called a pole. When, however, you magnetize a continuous ring of iron, the magnetic force, although strong within the iron, confines itself quite closely to it and produces but few effects outside; particularly there are no effects so localized as to be fairly called poles. All this will be more fully taken up at a little later stage of your work. It is well, however, to get a general idea of the facts here.

*Continued from THE ELECTRICAL WORLD, Oct. 10, 1891.

The World's Congress of Electricians of 1893.*

BY ELISHA GRAY, PH. D., LL. D.

From time immemorial it has been the habit of men to assemble in congress to deliberate upon all sorts of important subjects. The first electrical congress of which there is any mention is recorded in the book of Job; and this can scarcely be called an electrical congress, for all sorts of scientific conundrums were propounded to Job, who was one of the delegates. Among others were the following:

"Who hath divided a water course for the overflowing of waters, or a way for the lightnings of thunder?" and again, "Canst thou send lightnings that they may go and say unto thee—here we are?"

It is not recorded that any satisfactory answers were given to these questions, although Job was considered a wise man in his day and generation. It is very evident that lightning rods were not in vogue in those days; for not even the presence of Omnipotence (God, we are told, spake from a whirlwind) would have prevented the enterprising "agent" from exhibiting his doubled and twisted compound lightning conductors to the convention when the last question was propounded.

Notwithstanding all these years of discussion as to when, how and by whom the telephone was invented, it is very certain that it was subsequent to the meeting of this scientific congress, for otherwise could not Job have answered when the second question was put ("Canst thou send lightnings that they may go and say unto thee, 'Here we are'"), "Certainly, we can send lightnings, and make them say, 'Hello; here we are,' and say it in the vernacular." Since this first electrical congress there have been many held, but perhaps the most important one and the one most fruitful in results met at Paris in 1881. The benefits growing out of this congress to electrical engineering, and to the great army of inventors, teachers and workers in the lines of electrical progress, would be difficult to estimate. Ten years have passed since the Paris meeting and they have been years of unwasted activity. Where thousands were invested in electrical enterprises ten years ago, millions are employed now. And yet we are only stepping over the

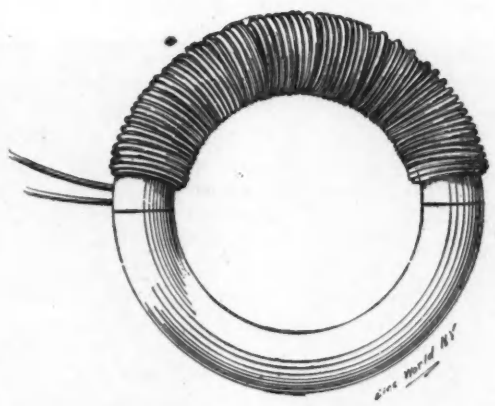


FIG. 15.—CONSTRUCTION OF A RING ELECTROMAGNET.

threshold of the door that leads to a vast unexplored region in the domain of electrical science.

Over 50 years ago there lived and taught a certain professor of physics. One day he explained to his class the experiments of Dr. Franklin with his kite, by which he established the identity of lightning and frictional electricity. At the close of his lecture he said to his class: "Young men, you were born too late to witness the development of this great science." If the shades of the departed are allowed to visit this earth and know what is going on, we can easily imagine the prolonged state of astonishment that our good professor has been in, during the years of his sojourn in the land of shadows, at what some of his pupils have lived to see.

It is eminently fitting that at suitable times and on suitable occasions, men in all departments of science and industry should come together for interchange of thought and the discussion of subjects that have to do with the great activities of life, practical and intellectual. What more fitting time to hold a series of conferences than during the great World's Columbian Exposition of 1893.

In pursuance of this object the World's Congress Auxiliary of the World's Columbian Exposition has been organized under the support of the Exposition corporation, and has been recognized and approved by the government of the United States. Under this organization local committees have been appointed to organize a series of congresses. Among others a committee in part to organize a world's electrical congress has been appointed. The movement as yet is in a formative stage, and much thought must be given to it before a detailed programme can be formulated. An advisory council must be appointed from the most eminent electricians of this and other countries. Some one or more than one must visit and confer with the noted men of the world, and no stone should be left unturned to make the electrical congress of 1893 the most important that the world has ever seen, not only in point of numbers, but in the eminent character of the men who attend, and the excellence and great importance of the work done.

While the hardest part of the work of organizing must necessarily fall upon the local council we expect much from the advisory committee, especially that portion of it residing in the United States. The fact that the great exposition of 1893 happens to be held in Chicago is an incident over which we have no control, but this fact makes Chicago the place par excellence for the assembling of the proposed electrical congress. The representatives of the world's best thought and best work will be centred here. The congress will meet under the shadow of the greatest palace of electricity the world has ever seen. In it will be found science applied—great thoughts translated into machines for the service of man.

To make the most of such an enterprise all petty jealousies between cities, states and nations must be dropped, and all must work as one common brotherhood for one common cause. Men must be selected on account of their fitness for the work assigned them, and for no other reason. Science and art know no east, no west, no north, no south. They belong to the brotherhood of men, however widely scattered they may be.

When a detailed programme has been systematically formulated by the properly constituted authorities—which will not be done until after consulting the most eminent minds on the subject—we invite and expect the most hearty cooperation from all men and societies that are interested in electrical congresses.

Before the present movement had been set on foot under the auspices of the government of the United States, through the Exposition authorities, several electrical associations (notably the Chicago Electric Club, the National Electric Light Association and the American Institute of Electrical Engineers) had started a movement for a congress to be held in 1893. If the congress was to be held under the auspices of any society, undoubtedly the American Institute would be the best selection in this country. As it is now, it remains for the officers of the World's Congress Auxiliary to suitably recognize the good work done by these associations, and for these associations to give us the benefit of their work already done, together with their hearty cooperation in the future.

The general outline of the congress will probably be as follows: It should be divided into sections according to the various interests represented. First, there should be a section devoted to the more purely scientific phases of the subject. This section should be composed of the most eminent scientific men in this and foreign countries. The standards that were adopted ten years ago will have had twelve years of trial by the time the congress assembles. It may be that other units should be added to those already adopted, or, that better definitions may be given to some of those already in use; papers should be ready by different individuals, relating to the different theoretical and scientific phases of the subject.

Other sections should be organized in the various interests of applied electricity, the number of which will be hereafter determined.

In order to give all a chance to see and hear the great men of the world, all of the sections should meet together on stated occasions, forming one grand general congress, to listen to papers and discussions by the most eminent men of the world in electrical matters.

It is suggested that all of the regularly organized electrical associations should hold their meetings in Chicago in 1893. Suitable halls will be provided in which to assemble for these various congresses and association meetings. The congresses, to be held under the auspices of the auxiliary department of the Exposition, will begin at the opening of the Exposition and continue to its close; so that no one will interfere with another. The time of the meeting of the Electrical Congress is not fully determined, but due notice will be given at a later date.

A little reflection will convince any friend of electrical progress that no place or time for holding such a congress as is proposed could be more auspicious than Chicago in 1893. The result of such a gathering of great minds, all centred upon one general subject, cannot be too highly estimated. Finally, success will be assured from the beginning if all our interested friends act harmoniously and are actuated by the one common desire that the best thing shall be done, without regard to geographical boundaries or local prejudices.

*Address before the Chicago Electric Club.

The Telephone in Madrid.

The telephone made its appearance in Madrid, says M. Pierard in *l'Electricien*, in November, 1883, under state superintendence; the exchange subscribers numbered about 650, more than one-third of whom were officials. In September, 1886, the Madrid Telephone Company took over the business, the government having worked it at a loss of some £2,000 per annum, and having refused the money necessary to render the system efficient. The company has an authorized capital of £72,000, of which half has been called up. The exchange subscribers now number some 1,800, or about one to every 270 inhabitants. Ader transmitters and receivers are employed. The circuits are twin wire and overhead. By a municipal decree no bare overhead wire of a greater length than half a kilometre is allowed, cables are consequently largely used; these are made by Rattier, of Paris, and contain 12 7-strand $\frac{1}{10}$ mm. wires, and weigh 1,160 pounds to the mile. The cables are suspended by steel hooks placed four metres apart from a 3 mm. steel bearer wire. The overhead wires are of silicium bronze and 1.1 mm. in diameter. The central exchange is situated in the upper stories of the Hotel de Madrid, the circuits all running to a huge circular metal tower. There are three auxiliary exchanges.

Electric Railroads at the Frankfort Exhibition.

BY CARL HERING.

The display of electric railroads on this occasion was different from what it would have been had the exhibition been in the United States. Although there was interesting matter exhibited, that which was not historical represented as a rule proposed or experimental systems and devices, rather than constructions that have been gradually developed from long and varied practice, such as has been had in the United States. This is no fault of the exhibitors, as they simply have not had such practice. When asked questions as to what their experience was in certain things, or whether their exhibit represented their usual construction, it was found that the exhibit was the first one of that kind made, or that they had not had a chance yet to get this experience, or that they had not yet developed a "usual construction," etc. The exhibits in general must therefore be looked at as proposed or experimental constructions rather than results derived from long experience.

The electric railroad exhibits included an overhead system in operation running from the exhibition through the city to the Opera House; an accumulator car running on the same line; a portion of the track for the conduit system used in Budapest; a mining locomotive in operation; historical models of their earlier roads; all these were exhibited by the enterprising firm of Siemens & Halske. The Schuckert company exhibited a short road with overhead and underground leads, the former in operation connecting two distinct parts of the exhibition; the Oerlikon company exhibited an accumulator car in operation running to one of the suburbs of the city. Mr. Pollack exhibited a small model road of an underground lead system without conduits. There was, besides these, a model of a mono-rail system (sometimes called the "bicycle" system) with underground conduits; also a drawing of the cars of the proposed rapid transit interurban road from Budapest to Vienna, designed by Mr. Zipernowsky. The latter road was fully described in an interesting paper reprinted in a recent number of THE ELECTRICAL WORLD, and will, therefore, not be referred to again here.

Of these exhibitors the firm of Siemens & Halske have not only the largest exhibit, but they have also had the longest experience of any firm on the continent. They were, in fact, the pioneers in this field, having built the first practical locomotive for mining purposes and exhibited it in Berlin in 1879, drawing three cars for six persons each. It had a drum armature and a transmission by means of gear wheels. The mining locomotive exhibited by them was low and compact, having a maximum breadth of 740 millimetres (29½ inches), and giving 10 h. p. with 150 volts. They use gear wheels and carbon brushes. The single line overhead system was used, with their substitute for a trolley, described below. The whole machinery is inclosed in a zinc case. It is the system in use for many years in the mines at Neustassfurt, Beuthen-ober-Schlesien and Zankerode. There are in all about 15 in operation.

The car of their overhead road is shown in the adjoining illustration, Fig. 5. The characteristic feature is their substitute for the trolley. In place of this trolley, which they claim jumps out from under the wire too frequently, they use a horizontal wire four or five feet long running crosswise to the car; this is pressed up against the overhead line, against which it slides. In the one exhibited the construction was slightly different and much simpler, and is shown in the cut; the contact wire was attached to a single bar making a T-shaped figure, the upper part having a bearing against the line and the lower part being hinged and overweighted at its lower end. Besides being a sliding instead of a rolling contact, and avoiding the rupture of the contact by a jumping out of the usual trolley wheel, they claim as additional advantages that the suspension of the line wires thereby becomes much simpler at curves and switches, in which they are doubtless right.

On straight stretches the line wire must be suspended slightly zig-zag so as not to cut grooves in the contact piece. An objection to it is that it wears out the line wire and that it makes a disagreeable hissing noise which is transmitted along the wire far enough to be distinctly audible almost one square each side from the car. The line wire was five metres (16 feet) above the track and was suspended between the tops of wrought iron tubular poles made by the Mannesmann process. The line wire is a six millimetre (full No. 3 B. & S.) iron wire, continuous throughout; it is connected at every 50 and 60 metres to a feeder, partly bare copper wire on the poles and partly underground. There is only one motor of 15 h. p. driving one pair of the four wheels with fixed axles. There are no trucks, but the wheels have a slight axial motion. There is a double transmission from the armature to the axle; the first pair is driven by a chain to reduce the noise, the second pair consists of two gear wheels. Fixed carbon brushes are used. The magnets are of wrought iron and the whole motor and gearing is inclosed in a zinc box. They used 300 volts on this line, but it was only about a mile long; it takes about 40 ampères to start the car which will carry 24 passengers. The only line at present operated on this system is that at Gross-Lichterfelde, near Berlin.

A form of truck used by Siemens and Halske is shown in

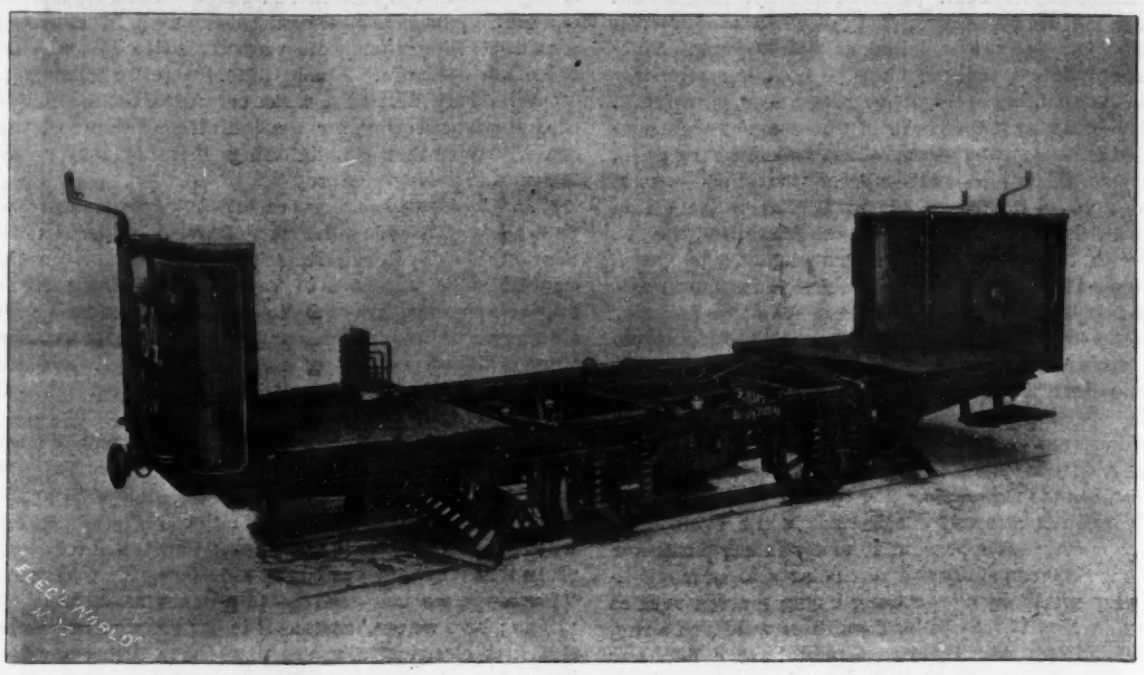


FIG. 1.—THE BUDAPEST ELECTRIC TRAMWAY CAR.

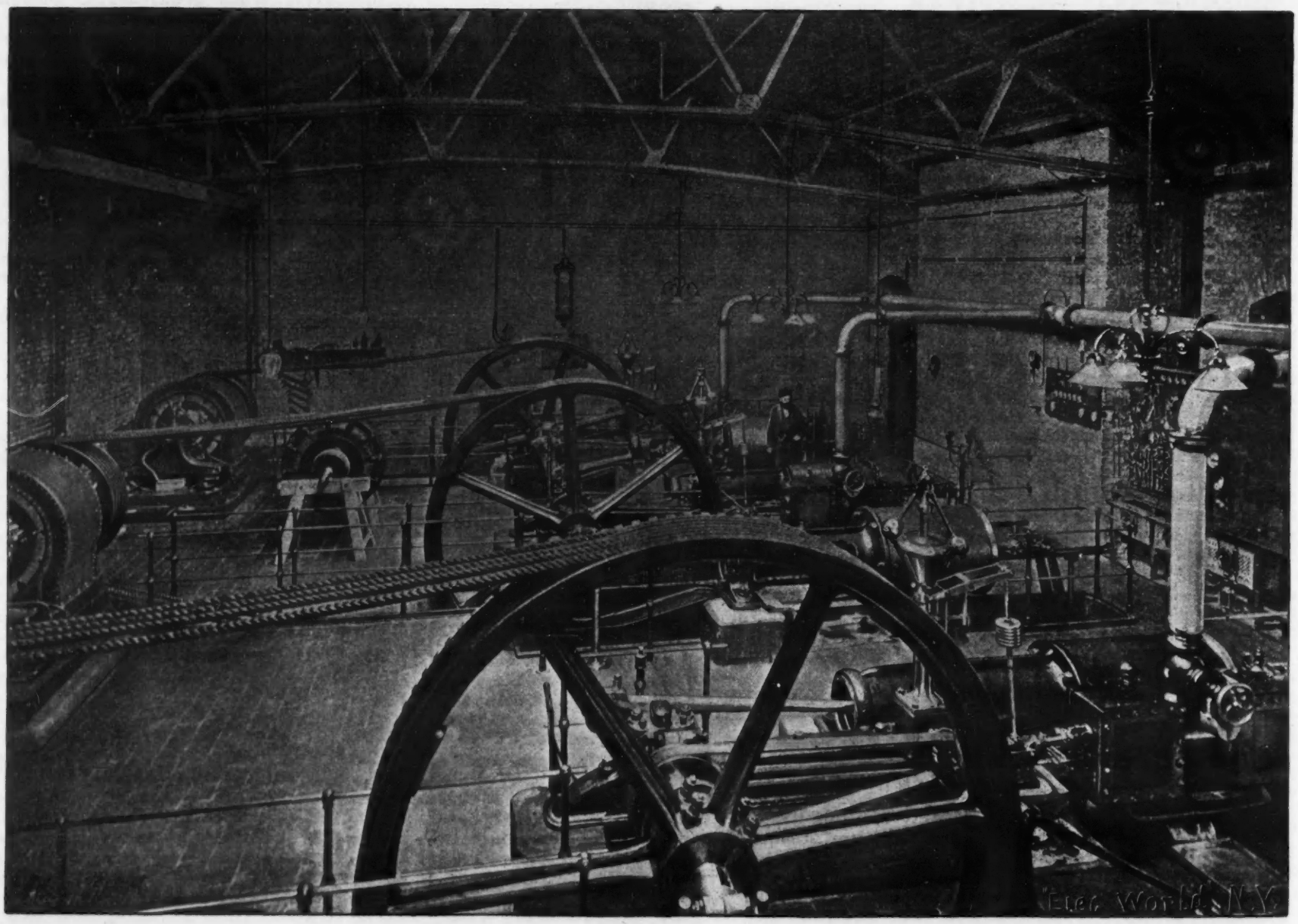


FIG. 2.—POWER STATION OF THE BUDAPEST ELECTRIC TRAMWAY.

the adjoining Fig. 3, which will explain itself. The gearing is in this case entirely by means of two chains, which is claimed to be less noisy than gear wheels. The second pair of wheels, which are not driven, are connected to the motor frame by means of a flexible coupling, which enables them to turn. Such cars with two trucks can readily go over curves of 12 metres (39 feet) radius. The trucks are complete in themselves, and can readily be secured to the bottom of any car which has previously been used for horse traction.

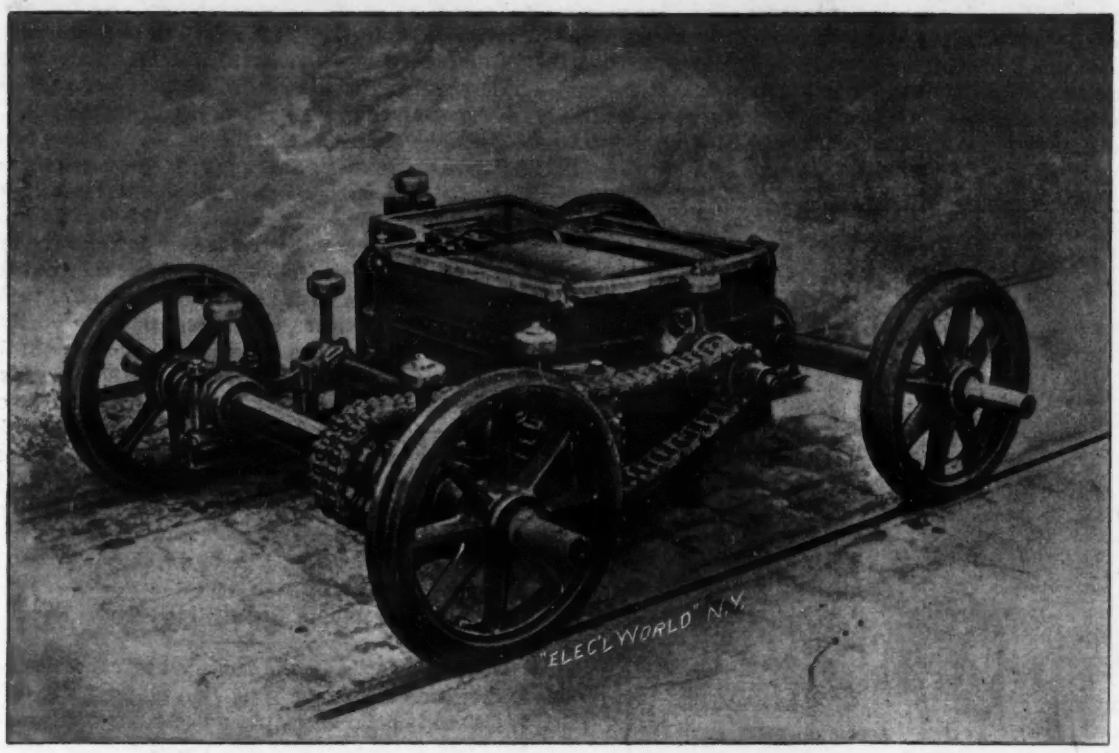


FIG. 3.—MOTOR TRUCK OF THE BUDAPEST ELECTRIC TRAMWAY.

The accumulator car was run occasionally on this line. It had two trucks of the kind just described, having each from 8 to 10 h. p.; they are very easily replaced in case of any accident or repairs. There are 162 cells of batteries of the Tudor system (a modified Planté cell), weighing about 2,200 pounds; the weight of the car without passengers is said to be about 17,600 pounds, and it carries about 40 passengers. The cells are used in three parallel sets of 54 cells (of about 110 volts) each; for starting they use a smaller number of cells, and in this respect it is an imperfect system, as the cells are thereby unevenly discharged. It takes 45 to 48 ampères to start the car. They will run for about five and one-half hours. The brushes are of carbon as usual. This system is not in practical use at present, but they are experimenting with it in Budapest.

Undoubtedly the most interesting system to the Americans, who can learn little from abroad regarding the overhead plan, is the underground conduit system of Siemens & Halske as introduced by them in the city of Budapest, the capital of Hungary. A section of the tracks and conduits of this system was exhibited, but a better idea of it may be had from the following description of the road as it is actually in use in that city.

The conduit as seen in Fig. 4 is placed under one rail. It consists of castings having flanges of 18 centimetres (7 inches) placed every 1.2 metres (about 4 feet), the space between being a conduit of concrete. The oval shaped conduit has a width, clear, of 28 centimetres (11 inches) and a height of 33 centimetres (13 inches).

The slot consists of two beam rails having no inside lower flange, and fastened to the conduit frames by wrought iron angle pieces. The width of the slot is 33 millimetres ($1\frac{5}{16}$ inches). The total depth of the foundation below the rail top is 70 centimetres ($27\frac{1}{2}$ inches). The conductors, both positive and negative, are made of angle irons, secured, as seen in the figure, by means of insulators fastened to the castings. They are sufficiently high above the floor of the conduit to be protected from the water which may collect in the conduits. They are, furthermore, under the top of the oval, so that they cannot be touched from the outside. It should be noticed that there is no earth return used in this system, as both leads are insulated. The water which runs into the conduits is collected at the lowest points and passes through settling boxes to the sewers. The second track may be of any desirable form, even only a flat rail. An objection to having the conduit under one rail instead of in the middle arises in cases where, by the nature of the course of the track and the curves, the cars become reversed in their positions on the track; such cases can probably be avoided by proper laying out of the road, and in the worst case by a second conduit under the other rail for parts where it cannot be avoided. On a one-track course the cars must have front and back platform alike, as they can not be turned around.

The car truck is shown in Fig. 1, and the motor in Fig. 3, being the same as described above in connection with their overhead system. It will be noticed that only one axle is driven, and that the other is flexibly connected to the third point of support of the motor frame. The starting, stopping, and reversing of the motor is done as usual by a crank at either end of the car, operating the same switches. Controlling resistances are placed under the body of the car.

Part of the generating station is shown in Fig. 2. This contains three compound condensing steam engines of 100 h. p. each; in another part there are two more of 200 h. p. each, driving direct coupled dynamos. The system is run with 300 volts, and all the dynamos lead to common bus wires. The leads are made of lead covered cables armored with iron bands and laid directly in the earth; these lead to junction boxes from which others run out along the road and are connected at intervals by means of short branch cables to the iron leads in the conduits.

The greatest up grades are 15 per cent. and 16 per cent., and the smallest curves have a radius of 50 metres (168 feet), 25 metres (84 feet), and 45 metres (148 feet); the latter is on a 16 per cent. up grade. The allowable speeds are as follows: 15 kilometres (9.3 miles) in the city, 18 to 20 kilometres (11 to $12\frac{1}{2}$ miles) in the outlying portions, 10 kilometres (6.2 miles) in the densest parts of the city, and six kilometres (3.7 miles) over street crossings. There are at present 20 kilometres (12.4 miles) of road in use, and 50 cars. Each car travels daily 120 to 130 and even 150 kilometres (75–93 miles) in a 16-hour service.

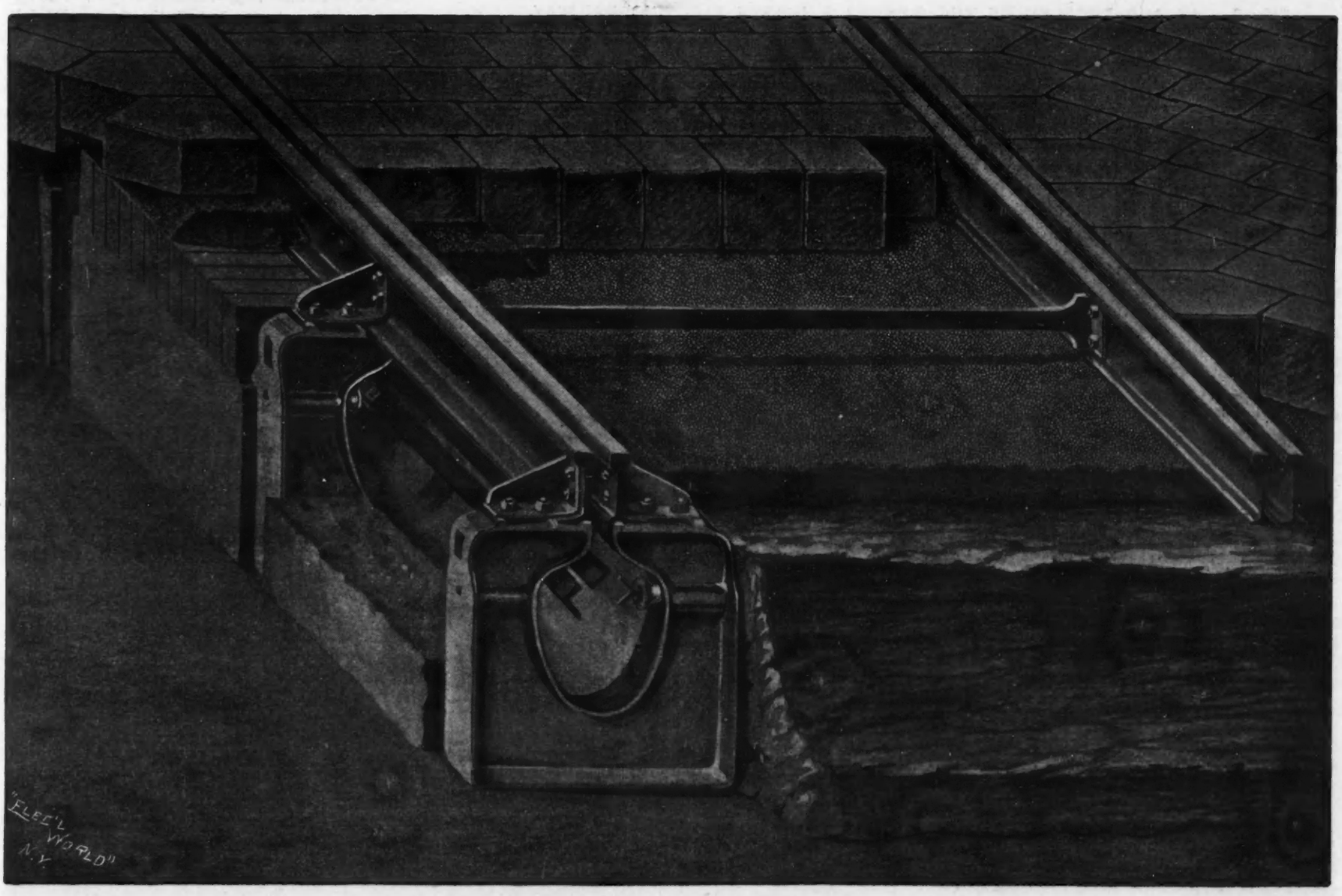


FIG. 4.—UNDERGROUND CONDUIT OF THE BUDAPEST ELECTRIC TRAMWAY.

The first part of the road, 2.5 kilometres (1.55 miles) long, was opened July 30, 1889, and has, therefore, been running over two years. The system has been so satisfactory that it is being extended quite rapidly. It was built at the expense of the firm of Siemens & Halske, and may, therefore, be said to be a practical experimental line of that company. They state that some Americans have

been negotiating with them to introduce this system on a large scale in one of the principal American cities, but the name of this city was not given.

In a public address one of the engineers of the company stated that at present the latest figures of cost of running was only 37 per cent. of the income, which certainly is remarkably low. The city tax, which is very high in Budapest, is not included in this. The following figures from the official reports of 1890 may be of interest, as also the deductions which can be made from the same.

There were running during that year three lines. The total number of passengers carried was 4,459,234; the total

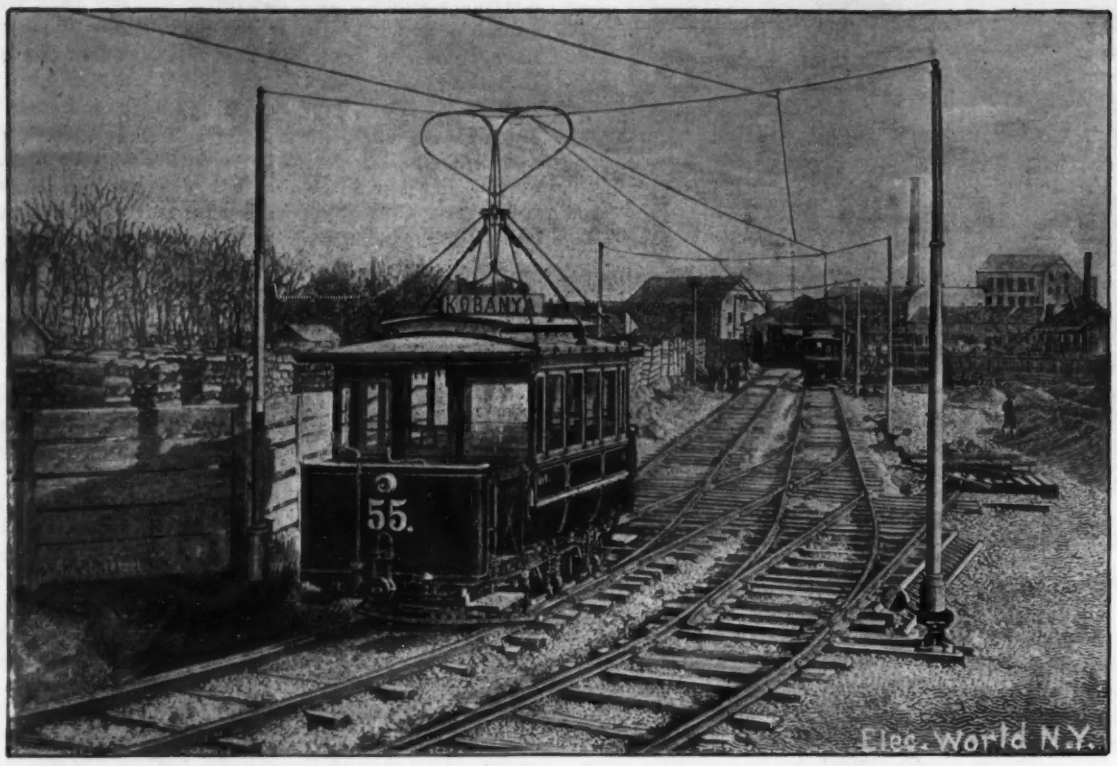


FIG. 5.—CAR AND TROLLEY OF THE SIEMENS & HALSKE ELECTRIC RAILWAY.

car kilometres were 758,838.1 (about 470,000 car miles); the total income from fares was 275,742.97 florins (about $113,000). From this it follows that the average number of passengers per car kilometre was 5.88 (9.48 per car mile); the average income was 36.27 kreutzer (about 14.8 cents) per car kilometre (about 24 cents per car mile); the income per passenger, that is, the cost of the ride to the passenger, was 6.18 kreutzer (2.53 cents). There were 6 kilometres of line in operation at the beginning of the year and 9.1 at the end.

To compare this with the corresponding official figures of the horse car lines of the same city, the total number of passengers carried was 18,107,543. The income from fares was 1,485,180 florins (about $609,000). The income per passenger, that is the cost of the ride to the passenger, was therefore 8.20 kreutzer (about 3.36 cents) as compared with 6.18 kreutzer for the electrical roads. The fares of the electrical roads are therefore cheaper, being 24.6 per cent. less than the horse lines, or the latter are 32.7 per cent. more expensive to the passenger than the electric roads. The frequency of the cars per kilometre of line was larger at the beginning of the year than on the horse car lines. and at the end was *double* the other. The income of the electrical road per kilometre of track was more than 1.5 times that of the horse cars in the latter half of the year. The latter figure, however, depends on the traffic in the particular districts through which the roads pass and is not necessarily a criterion in favor of electric roads; the income on the electrical roads, however, increased from 1,153 florins per kilometre of road in January to 3,621 in December, while that for the horse car roads remained about the same in December as it was in January, namely 2,267, against 2,124. The length of the horse car roads was 45.6 kilometres in January and 45.8 in December. Unfortunately the report does not give the number of car miles of the horse-car lines, so that no comparisons can be made with that figure. It should be noticed, however, that the length of the horse car lines was five times as great in December as that of the electrical lines, and it is therefore likely that the *lengths* of the rides were greater than in the short electrical roads. This is all the more likely from the fact that the number of car miles of the horse cars was omitted in the report.

Returning now to the other exhibits at the exhibition, the Oerlikon company, of Zurich, had a car running with their (Schoop) accumulators, in which a mineral gelatine is packed between the plates to hold the active material in place. They have been using a worm wheel gearing with the car motors which they have constructed, but they have abandoned this and now use a new motor. The lower shaft is the axle of the wheels. It has four poles and two carbon brushes, both of which are accessible from the top and are easily inspected. Like all their machinery, this motor is of rigid, well-designed construction. The single pair of gears is on the rear side. The motor is supported on bearings on the axle itself, and by a double spring suspension on the far end. This enterprising company will doubtless do some good work in the near future in electrical railroads, including, perhaps, some of the Swiss mountain roads in the Alps.

Mr. Pollack, of Paris, exhibited a small working model of a road in which there is a middle contact rail in short insulated section. The conductor carrying the current lies directly beneath this rail, and by means of flexible contacts momentary connections are made from it to that particular section of the contact rail over which the car is at that moment. These temporary connections are made by the aid of a magnet under the car which attracts an iron block under the contact rail. The principle is as follows: The pair of iron contact rails, laid in asphalt in sections, are inlated and the main lead covered conductor always has current; while flexible branches are connected to the brass blocks, which have iron cores.

The magnet on the bottom of the car in passing over attracts the iron cores, which makes the temporary contact to that section. It will be noticed that this is similar to the Lineff system. Pollack claims to have invented it in 1886, though not in just this form, which he devised a year later. The iron contact rails are double, in order that the magnetic circuit shall be open at the bottom, thereby developing a greater magnetic force there than if a single band of iron was used, through which it would be more difficult to attract a mass of iron on the other side of it. Permanent magnets are to be used, having in addition a winding through which the current may be passed to reinforce them. The independent spaces enclosing the movable blocks, being entirely enclosed by asphalt, may be kept dry. As there are two contacts to each section, it is stated that there is no sparking at these contacts, as the current is never interrupted there. In addition, he proposes to provide the car with a device (presumably some accumulators) to drive the car back on to the rails in case of derailing. This system is not yet in use anywhere. If these contacts can really be kept dry and free from sparks, this system looks like a very simple solution of the problem of an underground supply for the current.

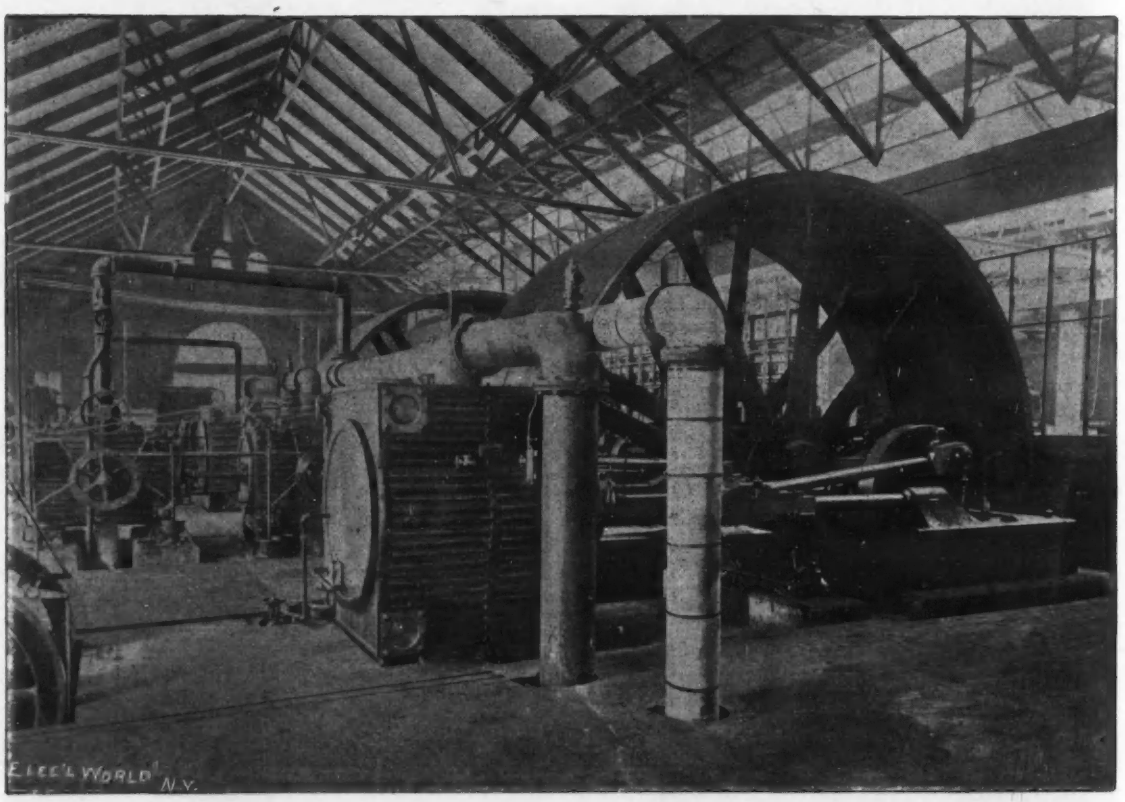
A modification of this was exhibited on a full sized road by Schuckert & Co. This road ran a distance of about 1,000 feet between two parts of the exhibition. It differed in the nature of the contacts, which were made of iron filings contained in little chambers under the rail. When attracted by the magnet on the car they bridged over from the main to the contact rail making the necessary connection. It is claimed that in this case if there should be sparking it would do no harm, as the iron filings would always present many new contacts. It was not in opertion, however, and a trolley system was substituted. The reason given was that the contact rail had been badly laid. The writer noticed that, even when the rest of the street appeared dry, there was considerable moisture in the narrow section of asphalt which separated the two ends of the sections, quite sufficient to conduct considerable current from one to the next, thereby doing just that which this system was intended to avoid. The iron contact rail was in this case a single flat band of iron, and not double as in Pollack's system. It is a question whether the iron filings will behave as they are intended to behave. It is ingenious but can hardly be called a good mechanical construction.

The West End Power Station in Boston.

No power station in the country has attracted more attention than that of the West End Street Railway in Boston, since in point of size the proposed station far surpasses anything of the kind that has ever been built. Street railway men will be especially interested in watching the progress of the work now that the work on one of the big engines has so far advanced that the engine has been given a trial run.

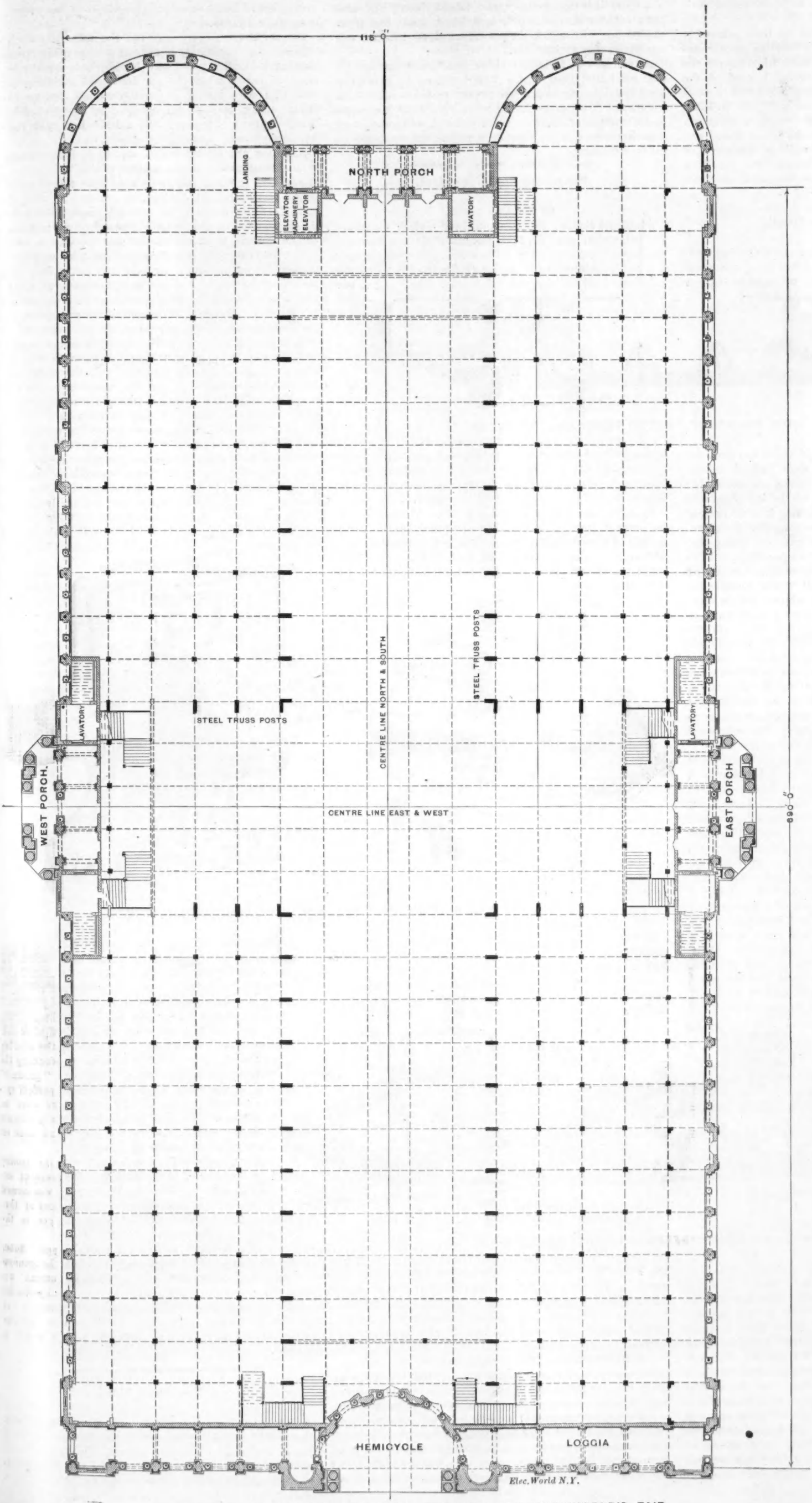
On Monday morning of last week at 10 o'clock, President Henry M. Whitney started one of the two immense engines now in place out of a series of 13 which it is expected will be in use when the plant is complete. The engine is of the Reynolds-Corliss triple expansion type. The fly wheel is 28 feet in diameter, 10 feet 7 inches face and weighs 80 tons, using two belts each 4 feet 6 inches wide which will run 6,000 feet per minute. A mammoth piece of countershafting, said to be when completed the largest in the United States, is in the basement to which the main belts run. These countershafts are in sections of 40 feet in length connected with enormous friction clutches allowing each engine to be used separately or together, making two lines of shafting of 240 and 280 feet in length respectively.

The generators will be located on the floor immediately above the shaft basement and opposite the engine room, and are now being built for this purpose. There are to be 34 of them of 500 maximum h. p. each—height 9 feet, width 8 feet, length 16 feet, and they will weigh in the neighborhood of 35 tons each.



ONE OF THE 2,000 H. P. ENGINES IN THE WEST END POWER STATION, BOSTON, MASS.

To give our readers some idea of the size and capacity of this power station we append the following figures as they will be when the plant is complete: The engine house has a length of 315 feet, and width of 170 feet. The boiler house is 160 feet long, 80 feet wide, and will contain 24 boilers, the stack for which is 252 feet high. The present capacity may be summed up as follows: This station has a capacity of 12,000 h. p., and the Cambridge station 5,000 h. p., with a capacity for operating 850 long cars.



REVISED PLAN OF THE ELECTRICAL BUILDING FOR THE WORLD'S FAIR.

The Revised Plan of the Electricity Building for the World's Fair.

Since the publication of the original plans of the electricity building for the World's Fair a number of important changes have been made in the proposed design by Mr. E. E. Keller, the assistant chief of the department of Electricity. The cut shown on this page gives the floor plan of this building according to the revised plans. The outside dimensions are shown in the illustration. In order to gain all possible space for exhibits and to make the landings both at the foot and head of stairways come where there would naturally have to be an open space, the original location of the stairways has been changed and these have been placed in more suitable positions. The two steel arches, each carrying a bridge and staircases in the centre of the building, have been removed entirely, giving an unobstructed view from one end of the building to the other, and permitting of the erection of some spectacular effect in the centre of the building. The very small stairways originally located at each corner of the building have also been removed to a more suitable location. These stairways have been made considerably wider, and being in better location will be more of an accommodation. The staircases as at present planned are eight in number, and are located on each side of the main entrances on the four sides of the building. The stairways at the south main entrance will take up practically no room that could be used for exhibits, as the space would need to be vacated on account of the space being required to accommodate the crowds.

The stairways at the north entrance are located so as to take up very little room on each side of the small rooms to the right and left of the entrance. The grand staircases at the east and west entrances are so located that they land directly in front of the entrance, where a large space would naturally be left. They then turn up over the ceiling of four large lavatories underneath the stairways, landing on the gallery in a very suitable place.

The original plans contemplated only four small lavatories, but these have been each increased to almost double their original size, and four others have been added on the gallery floor directly above the lavatories underneath. The passageways connecting the galleries on all sides of the building have been doubled in width, as they were deemed too narrow in the original plans.

Arrangements have been made to devote the two large bays on the ground floor at the north end of the building to the use of the restaurant service. The use of these two bays on the gallery floor for a lecture room and committee rooms is at present under consideration. The galleries in the building have been changed so as to give an available floor space of over 145,000 square feet, or 3.33 acres. Even this area can easily be increased by the closing up of the narrow light-wells in the centre of each gallery section, and the connection of the two gallery sections on each side of

the building; this, however, will not be done unless it is absolutely necessary.

The cross section of the building has been somewhat changed for the purpose of giving the building greater stability against wind pressures, at the same time giving the interior a much handsomer appearance. Instead of the timber work supporting the central roof there will be steel arches for this purpose. In the exterior of the building there have been made no changes worth mentioning. Several plans of the aisles have been made but these can probably not be arbitrarily laid out until the allotment of space in further advanced. Arrangements have also been made for eight large electric elevators, but these have not yet been definitely located.

The New Peckham Truck.

Electric traction has been productive of many improvements in car trucks. The addition of two heavy motors to the car equipment, and the necessity of supporting them

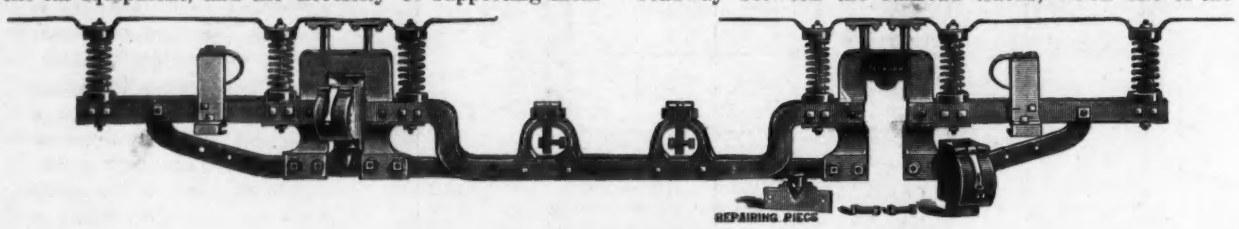


FIG. 1.—SIDE FRAME OF LATEST PECKHAM TRUCK.

directly upon the trucks, made the old styles too weak for the service, while at the same time their lack of rigidity became more and more noticeable. To-day the electric car truck is a special development, and of the inventors who have exercised their ingenuity in bringing it to its present perfect standard none is better known than Mr. Peckham. Last year his cantilever truck with an extended spring base attracted a good deal of well deserved attention, and in its latest form of the new radial geared cantilever truck are embodied several new features well worth considering. Fig. 2 shows the completed truck as adapted for the usual styles of motor. Fig. 1 shows the extension side frame in its latest form. The object of designing this particular truck was to obtain the maximum flexibility possible in a four-wheel truck, and to this end the axles are cushioned n a very ingenious and effective manner, and besides are given the advantage of a perceptible though small radial flexibility. The side frames are composed of wrought iron and steel bars riveted to yoke pieces of malleable iron so as to form a practically continuous structure. The extensions that support the end springs to prevent swaying of the car body are rendered rigid by a cantilever truss, as shown in the figure. The bend in the side bar is for the purpose of allowing the free removal of the armatures sidewise. The most interesting portion of this special truck, however, is the radial gear intended to give flexibility to the axle connections and to provide cushioned supports for the boxes. The malleable iron yokes that support the side frames upon the journal boxes are formed with sockets in the upper sections, into which are inserted rubber cushions, shown at *B*, Fig. 3, and then the upper section of the ball bearing *C*, Fig. 3, constructed of the same size and shape as the apertures in the yoke. The lower sections of the ball bearings fit into sockets in the journal boxes, but with a little more play than usual to give increased springiness in the whole structure. The whole weight of the side frames rests upon the rubber cushions inserted between the yoke and the upper section of the ball bearings. The lower section, *E*, Fig. 3, serves simply to steady the boxes, and this is carried direct-

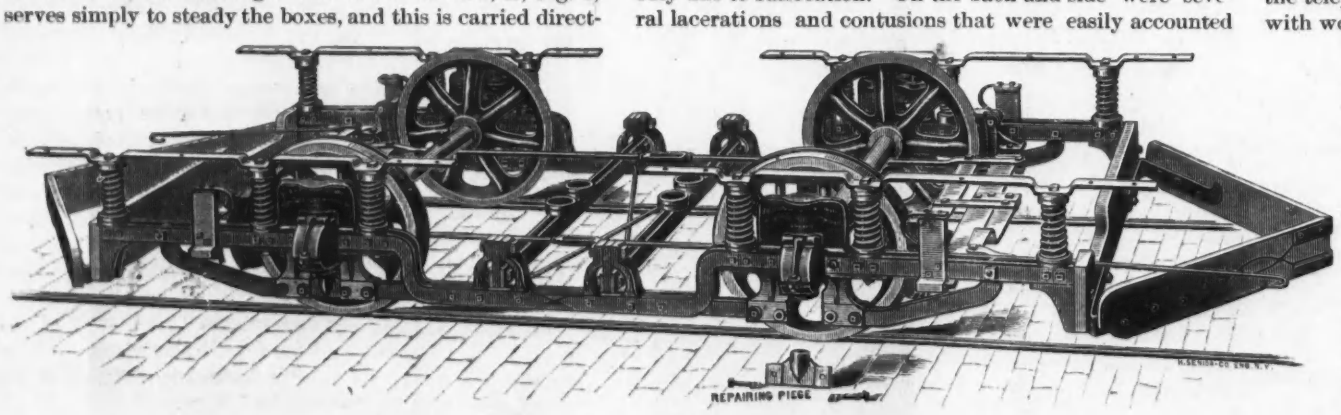


FIG. 2.—PECKHAM PREFECTED CANTILEVER TRUCK.

ly by the repairing piece *E* thrust into the lower portion of the yoke and held in position by the bolts shown in Fig. 4: removing these enables the side bars to be completely detached from the boxes. Fig. 4 shows the general appearance of the yoke and its attachment, just as Fig. 3 shows the same in section, excepting the journal boxes and the various cushioning devices that are employed. The car body is of course supported on the springs upon the side frames and given additional steadiness by the double plungers bearing in the yokes. Add to this truck frame the cushioned wheels introduced by Mr. Peckham and it is about as thoroughly flexible a truck as it is possible to design while retaining a fixed wheel base. The success of the arrangements is evidenced by the exceedingly smooth riding of cars fitted with this truck: one has been in operation some little time on the Coney Island electric line, and has given the utmost satisfaction, being quite free from sudden jars with which the passengers on electric cars are sometimes only too familiar.

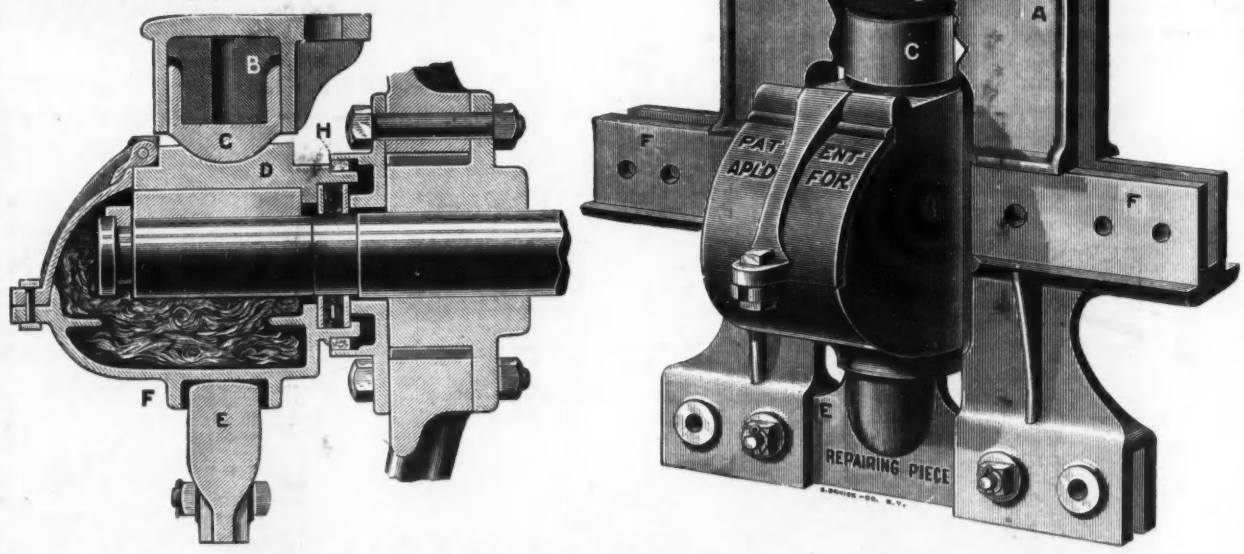
As will be seen from the above and former descriptions that we have given of the improvements in street car trucks, the introduction of the electric motor as a factor in street railway operation has caused a very decided advance in the business of street car truck building, and many more improvements will doubtless be made as the necessities of the case demand.

The Grand Rapids Accident.

BY FRED DE LAND.

At Grand Rapids, Mich., about three o'clock on Saturday afternoon, Aug. 29, 1891, George Hydorn, a teamster employed by the Crescent Mills, was endeavoring to control his frightened team of heavy draught horses on the roadway between the railroad tracks, when one of the horses plunged against a heavy telegraph pole with a force that crushed the muscles of the left fore shoulder "to a jelly," and caused a rupture of the diaphragm and of the pericardium, death resulting a moment later.

In falling the horse carried his driver, who was then on the ground, down with him; the rear portion of the 1,600 pounds of horseflesh striking Hydorn's abdomen and chest with terrific force, "forcing the air completely out of his lungs, preventing inspiration, and causing death quickly by suffocation or asphyxia."



FIGS. 3 AND 4—YOKE AND JOURNAL BOX OF PECKHAM TRUCK.

Hydorn was about 28 years of age, weighed about 160 pounds, and was 5 feet 10 inches in height. The post-mortem examination conducted by Dr. S. C. Graves showed a healthy condition of the body and that death was undoubtedly due to suffocation. On the back and side were several lacerations and contusions that were easily accounted for, but on the back were also *some blisters*, the presence of which the family physician claimed could only be accounted for by the action of an electric current, although no wire had come in contact at any point with the bare flesh, so far as was shown, nor were any holes burnt in the man's clothes.

Veterinary Surgeon L. L. Conkey testified that a post-mortem examination of the horse revealed that the animal's death was due to the concussion received in coming in contact with the telegraph pole, as evidenced by the crushed condition of the muscles on the left fore leg, the partially ruptured diaphragm, the highly congested lungs that were filled with blood, and by the ruptured pericardium that was *covered with adipose tissue*. But not a sign of a burn or of any other effect that could be traced to the electric current was visible. Death would have resulted from either of these three injuries.

Coroner Bradish's jury rendered the following verdict: "Death was caused by a current of electricity passing through a small copper wire having been broken by a team of horses which he was driving by colliding with a pole, said wire falling across the trolley wire on West Bridge street, owned and operated by the Consolidated Street Railway Company. We further find said trolley wire not properly protected by guard wires."

And over the United States was flashed the message: "The deadly trolley claims another victim."

And here is where electricity may have played an incidental part in this sad accident.

On the lower crossarm of this telegraph pole a private telephone wire of No. 16 hard drawn copper was fastened to the outside insulator on the side opposite to that on which the horse fell. The force of the shock caused by the momentum of the runaway team and heavy dray threw the top of the pole several feet out of alignment, snapped the pins supporting the telephone wire and broke the wire at the next pole, the entire length of the two spans, some 250 feet, falling to the ground, while the supported end crossed over a live trolley wire carrying a current of 500 volts, though there is no evidence showing that the telephone wire made a perfect contact with the trolley wire. Between the trolley wire and the man's body the fallen telephone wire was stretched along the wet ground for more than 25 feet, and no fusing marks are noticeable on the wire where it came in contact with the wet earth, or with other wires, or where it was cut in two with a hatchet. Had there been a perfect contact between telephone wire and trolley wire possibly the former would have been fused off, or at least the switches in the station house would have opened the circuit, as they are sensitively adjusted. The only reliable evidence showing that the telephone wire made even a partial contact with the trolley wire was the burning out of the coils in the private telephone box.

It had rained heavily the night before, and in a mud hole in the roadway the dead horse lay on its dead driver for from seven to nine minutes, simply because an insane fear held back the crowd from rendering assistance so long as the telephone wire passed around Hydorn's leg covered with woolen trousers, and under his back where it was pressed down in the mud, and left no sign of contact on his woolen coat. As remarked, the wire lay on the wet ground for 25 feet before reaching the body, and no indication of a "leak" or a "ground" was perceptible at the station, where a perfect system of reports is maintained, and there were no marks to indicate that the wire had come in contact with the bare flesh. Yet the jury found that an electric current caused Hydorn's death.

The absence of the guard wires over the trolley wire is explained by the fact that the accident occurred on the very first day that current was turned on that circuit and that the guard wires at that point had been left off till some changes in the poles could be made.

This accident occurred six weeks ago. Sober second thought has materially modified the opinions of many who then thought the electric current was responsible for this death, and were an exactly similar accident to happen under the same circumstances and affecting the same individuals it is safe to assume that a verdict of an entirely different nature would be rendered.

A New Snow Plow.

A new snow plow for electric street railway purposes has recently been brought out by the Eastern Electrical Supply Company, of Boston, Mass. This plow is designed with foundations to accommodate any motor system. The accompanying illustration shows the design of these

plows, which are built of hard pine frames 17 feet long and 6 feet 2 inches wide. A dasher 6 by 8 is placed on each end, the sides of which are provided with hand rails. A V-shaped wooden nose or plow reaching over the track 15 inches is attached to each end, which serves to throw the snow away on each side, while a leveling wing extends out 4 feet, hung fore and aft, and held in place with hooks. These wings are raised with ropes and stand up at the side of the body when not in use. To clean the track of snow and ice four diggers are applied, made of 2¼-inch square Norway iron, with steel feet, which are operated by levers on the body of the plow, with four grounding brushes. A lever attached to each end of the body is used to hoist and lower the plow, so that when one end is in use the other can be raised up out of the way. The plows are mounted on four car wheels and are substantially built to do anywork in track cleaning required in the heaviest winter weather. The manufacturers report a large number of orders from companies which will use these plows during the coming winter.

AN ELECTRIC SNOW PLOW.

Electrical Welding at the Okonite Company's Works.

The development of automatic electric welding since its success was established from a commercial standpoint by Prof. Thomson has been in keeping with that of the many industries which have arisen as the result of the application of practical electricity. It was but a short time after Prof. Thomson established the fact that the International Okonite Company, whose manufactory is located at Passaic, N. J., leased its first machine and two small welders, one for copper and the other for sheathing wire. The small generator was worked to its full capacity, and the results were so encouraging that the Okonite company decided to abolish its old method of hand splicing, which, although in the hands of skilled workmen, as compared with electric welding was a most tedious and crude process. As a result of the trial the small generator was returned to the Welding company, and the present plant now in use at the works of the company was installed. Through the courtesy of the management, a representative of THE ELECTRICAL WORLD was recently accorded a personal inspection of the plant and an opportunity given to witness the process of electric welding. The illustrations shown represent machines in use on the main and second floors at the company's works. No. 1 represents two welders, one a small bench machine, No. 2 a large machine working on the main floor. The present generator is a self-exciting, constant potential alternator, of a capacity of 30,000 watts. It is belted directly to a Ball automatic engine provided with extra heavy or "railroad" fly wheels, a constant speed being thereby maintained in the event of sudden demands on the generator, as frequently happens in this class of work.

The welders used are what is known as type "1 A" for iron armoring or sheathing wires; two of type "2 A A" for copper from No. 6 A. W. G. to No. 20 A. W. G.; two of type "10 A A" for copper from half inch to No. 6 A. W. G.

After the wires are prepared for the weld, clamped and given the proper projection, the time of application of the current is but a small fraction of a second for all of the smaller sizes, such as telephone and telegraph wires. The heat necessary to form a perfect union is all concentrated at the tip ends of the abutted pieces, and advantage is taken of this fact in welding wire already insulated, it being only necessary to remove the insulation far enough to permit of the wire being clamped. As the welders are situated in different parts of the factory, it happens that many times there is simultaneous welding on all welders, making heavy and sudden demands upon the generator. A large 3,000 watt transformer in the testing department is continuously operated by the small generator, taking 300 volts and 10 amperes for primary, and giving a maximum of 20,000 volts in secondary.

At a first glance electric welding looks the simple application of a current to obtain required results. Such is not the case, however, as different wires require different projections of abutted pieces, different current strengths and pressures on abutted pieces, and again, the current must be interrupted at the proper moment. To apply the proper conditions to every wire in making a weld requires no extra amount of skill on the part of the manipulator. In the case of end pressure on the abutted pieces, it is applied according to the number of weights given in a table which has been previously worked out and the current strength for each wire is varied by simply moving the shield on the reactive coil placed near the welder.

If electric welding as done at the Okonite factory is to be taken as any criterion, it would seem to be an assured success. The plant is now running at full capacity, the average daily output of copper, including all sizes, being about five tons, averaging about 200 welds.

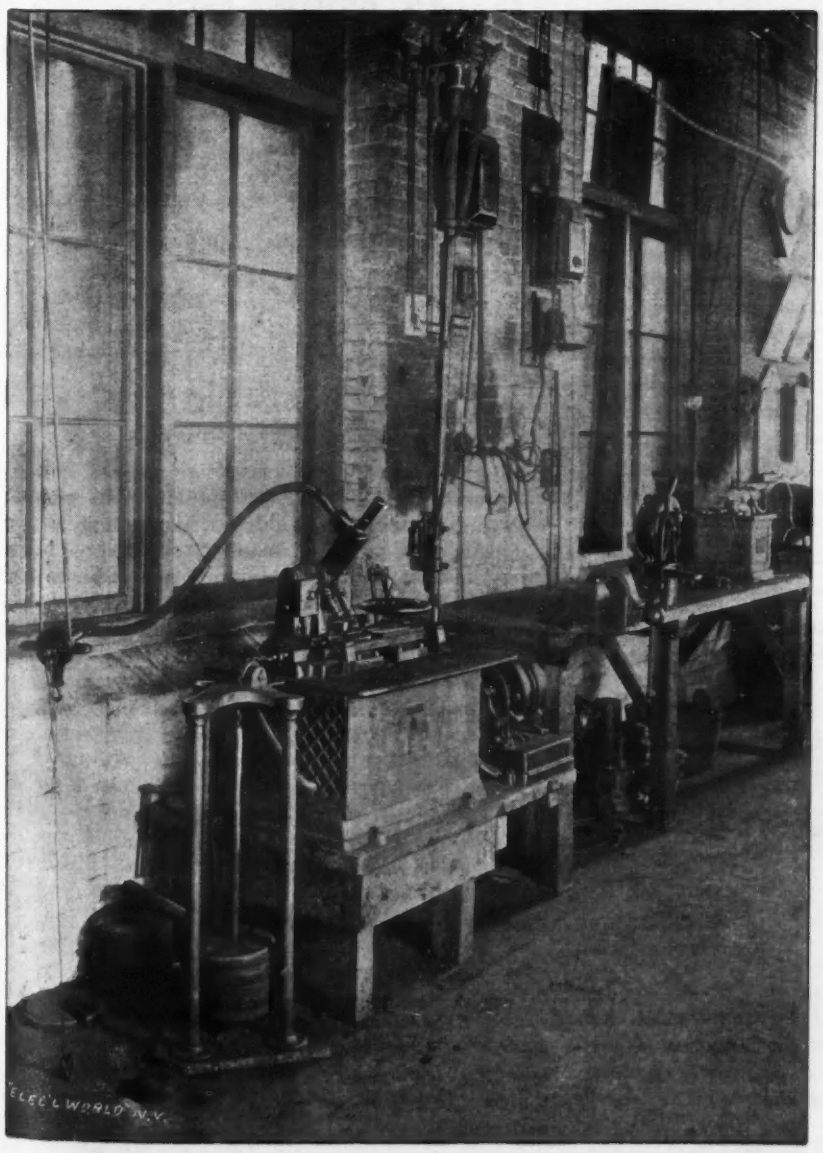


FIG. 1.—ELECTRIC WELDING AT THE OKONITE FACTORY.

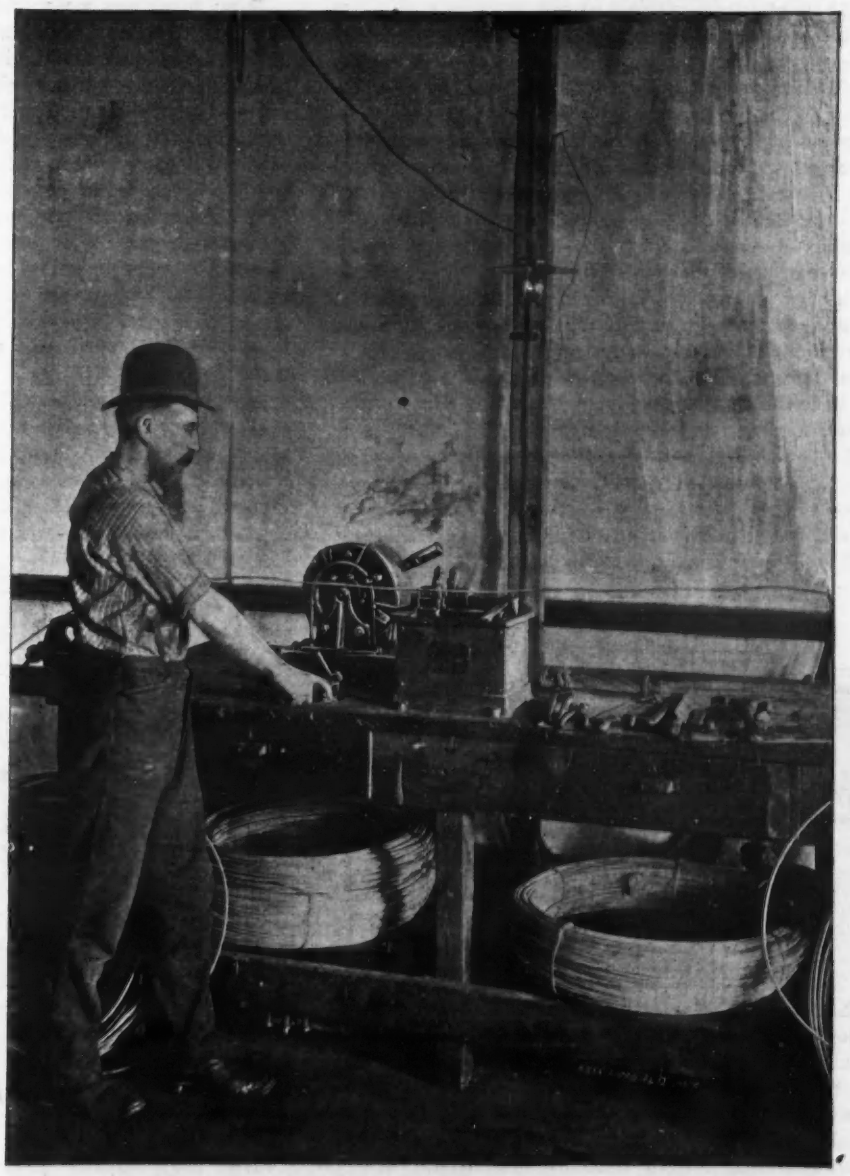


FIG. 2.—ELECTRIC WELDING AT THE OKONITE FACTORY.

The Creaghead Trolley Line Insulator.

The superiority of glass as an insulator is recognized by all and would no doubt have been adopted for trolley line insulation heretofore, had any one devised a practical plan of connection between the trolley wire and the span wire, securing the glass insulator against breakage.

The glass insulator, screwed on the wood pin, has been used in electrical line work for years and is recognized as the best practice for line insulation. The wood acting as a cushion, adapts itself to any condition arising from unequal

Fig. 1.—Creaghead Trolley Line Insulator.

expansion of the wood and glass, thus securing the glass insulator against breakage.

The Creaghead Engineering Company, of Cincinnati, has designed a glass insulator, as shown in Fig. 2, which consists of a grooved glass insulator into which is screwed a wooden plug. The bolt has a round head at the top and a thread at the bottom and is screwed into the clamp.

The method of connecting the insulator to the span wire is very simple and secure. The yoke shown in Fig. 1 fits loosely in the groove of the insulator, as shown in Fig. 2. The inner curve of the yoke, coming in contact with the insulator, is a half circle with a slightly larger radius than that of the smallest circle of the groove. It is necessary to remove the yoke from the insulator about three-quarters of an inch before it becomes disengaged from the groove. The yoke can be put on and taken off of the span wire easily and without tools. All strains on the insulator tend to increase the hold of the yoke and span wire on the insulation. While the attachment of yoke and trolley wire is

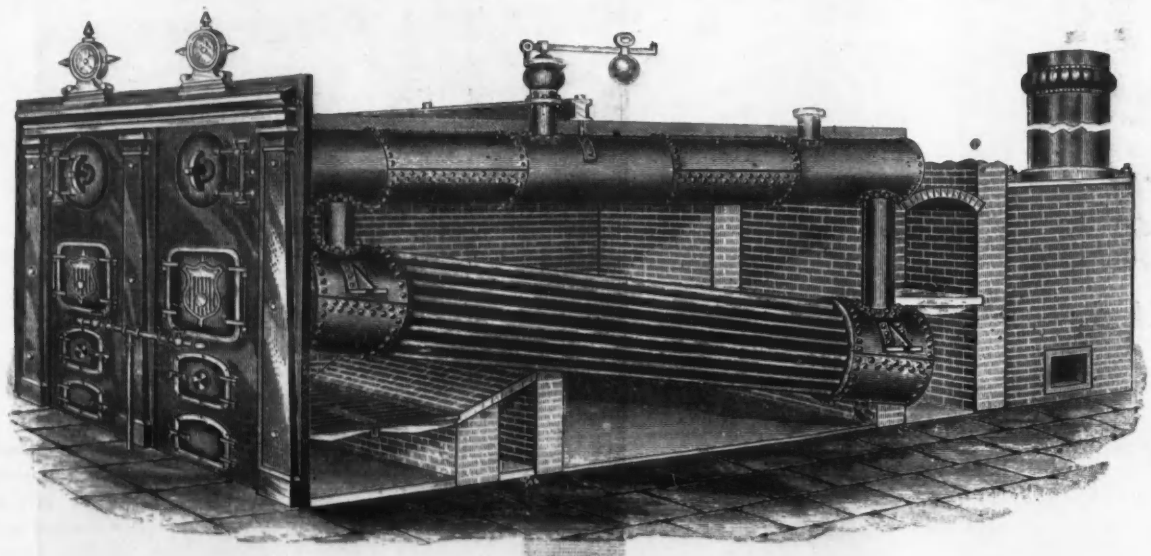
Fig. 2.—Creaghead Trolley Line Insulator.

secure, it is at the same time flexible, and will adjust itself to unequal expansion of materials.

The action of this insulator where it is in use fully comes up to the company's expectations, and the result is very encouraging.

Wood's Water-Tube Boiler.

We illustrate in this issue Wood's water-tube, fuel-saving, safety boiler, manufactured by the Schuylkill Foundry



WOOD'S WATER-TUBE BOILER.

and Machine Works, of Conshohocken, Pa. The feature brought out in the construction of these boilers, is the fact that they are built on the correct principle for the generation of steam at small cost for fuel, being simple in construction, efficient, economical, durable and safe, adapted to the work of electric railways and electric light plants, and all stationary purposes where increased power and economy in fuel are desired. Many of the largest power plants and central stations in the country are using them and it would seem from testimonials which the manufacturers have received that they are giving the best of satisfaction.

Winton Insulators.

The accompanying cuts show in two forms the Winton insulator, as manufactured at present. The features of this insulator are the interlinking hooks inclosed or embedded

THE WINTON RAILWAY LINE INSULATORS.

within the insulating material, preferably hard rubber, the hooks being separated from each other by means of a layer of hard rubber secured between them and also covering the whole body portion, the whole being vulcanized together in one piece. Each interlocking hook is provided with a threaded stud projecting from its extremities, one of which is adapted to receive a clamping ear and the other adapted to receive interchangeable supporting pieces arranged for attachment to a supporting wire or bracket, as the case may be. The principle of the interlinking hooks gives strength to the whole body or bell portion, and at the same time a high grade of insulating material being used, it requires only a small amount of such material to make a perfect insulator.

These insulators are now made in two forms, as shown in the illustrations. One is a bell-shaped piece, having projecting studs to receive the interchangeable fixtures, which is shaped to be as perfect a shed or drip as possible for rain or moisture, and another form adapted particularly for straining wires, being egg-shaped and provided with washers at each end to make as perfect an insulation as possible between the two studs.

The clamping ear which is used with this insulator is a very simple and compact piece of mechanism. It consists of a slotted clamp portion, having a curved sectional form, to which the trolley wire is fitted, a thread being partially cut in each portion, by which it is screwed to the stud, and a yoke which is fitted over the clamp portion prevents it from spreading. This yoke is provided with projecting curved pieces to fit over the trolley wire to firmly bind it, and when the bell portion of the insulator is screwed into the slotted thread of the clamp, the trolley wire is firmly bound within it. The clamp portion is so cut away at the ends as to provide a perfectly smooth runway for the trolley.

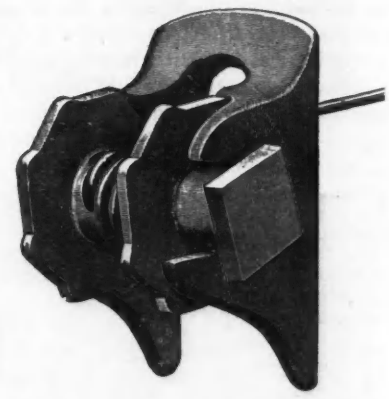
The attaching pieces which are screwed to the other stud are of various forms. One is so constructed as to weave over the supporting wire and is called the span. Another form, called a hanger, can be used upon the same stud and is provided with eyes to which the portions of a supporting wire may be attached. A double and single curve can be secured upon this same stud and also a bracket adapted to fit a projecting arm. The pear shaped body portion is used more for straining wires on curves and can be fitted with interchangeable parts in the same manner as the bell; that is, instead of a curved fixture with the trolley ear attached, two eyes may be screwed upon the studs and it can then be used for a strain.

A kinking machine forms part of the equipment and is very simple in construction. It can be carried along the line, and by hanging it upon the wire and giving one turn of a lever handle a slight kink in the trolley wire will be produced exactly corresponding to the sectional shape of the trolley ear. This is accomplished by a cam, leaving the wire ready to attach the bell and ear to.

The Eastern Electric Supply Company, Boston, Mass., is exclusive selling agent for these insulators.

A Span Wire Tightener.

The illustration shows a span wire tightener, simple in its construction, designed in two parts. It is substantially

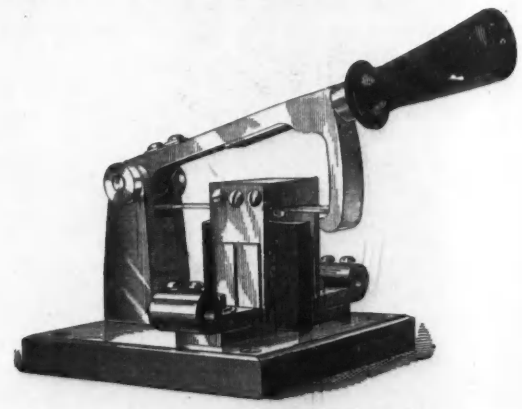


Railway Span Wire Tightener.

made, and is offered at an extremely low price, considering its utility. It is manufactured by the Electrical Supply Company, corner Randolph street and Michigan avenue, Chicago, Ill.

The Weston Quick Break Switch.

Visitors to the Pittsburgh convention are interested in this new railroad switch, an illustration of which is given in this issue. The parts are of highly polished red brass and hard rolled copper, mounted on a handsome base of marbleized slate. Mechanically it is well designed, the wearing parts being made strong and durable and easily replaced, being interchangeable. The contacts are of ample proportion to carry an excess of current in all cases above rated capacity, the breaking being done quickly



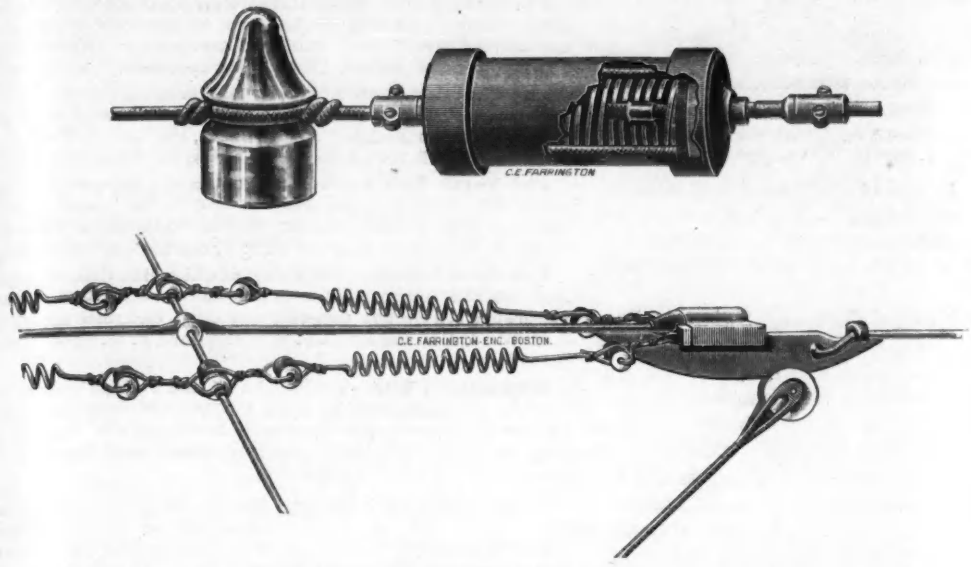
WESTON QUICK BREAK SWITCH.

by means of a tempered steel spring, which tends to prevent arcing.

It is made in three sizes, from 150 to 450 ampères capacity, and in special sizes up to 1,000 ampères. Wm. H. Weston & Co., consulting and manufacturing electricians of Philadelphia, Pa., have recently placed it on the market, and report receiving the highest endorsements from those who have investigated the practical working results claimed for it.

Safety Devices for Electric Wires.

The Electric Wire Safety Attachment Company, of Boston, is putting upon the market safety devices for railway or other power circuit wires which for simplicity, durability and moderate cost seem to meet all the requirements for which they have been designed. As will be seen by reference to the accompanying illustrations the appliances are very simple. Fig. 2 represents a trolley safety device in position for use, with the trolley wire drawn up and the plate to which the end of the wire is attached being inserted in the slide at the end of the wire projecting from the tie or supporting wire, which is slotted to receive it, thus forming the connection and holding it in position unless the wire should break. In this case the springs would draw this plate out and away from the other, allowing the trolley wire to drop down, thus breaking the connection and rendering the broken wire perfectly harmless until it could be repaired. A great advantage of this appliance lies in the facility of attachment, as the springs may be put in place and removed if necessary without interfering in any way with the line.



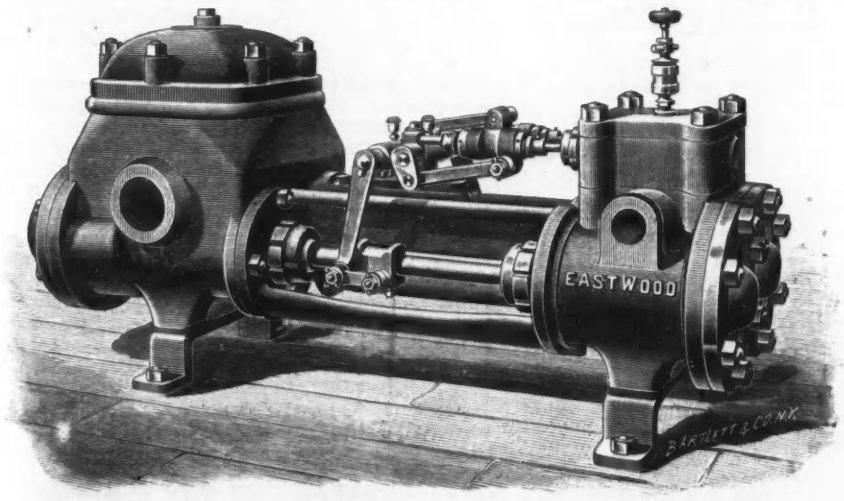
FIGS. 1 AND 2.—SAFETY DEVICES FOR OVERHEAD ELECTRIC WIRES.

The other piece of apparatus shown in Fig. 2, although suitable for trolley wire by slight alteration, is especially constructed for electric light and other line wires. It is suited for use in the protection of telegraph, telephone and fire alarm wires where they cross trolley, electric light or power wires, since it is small and easily put in position and requires little or no attention after once up.

The protector is enclosed in a suitable waterproof material, the cost of construction being very moderate. These devices have been put to some very severe tests, in all of which, it is said, they have proved their capacity for doing all that is claimed for them.

The Eastwood Duplex Steam Pumps.

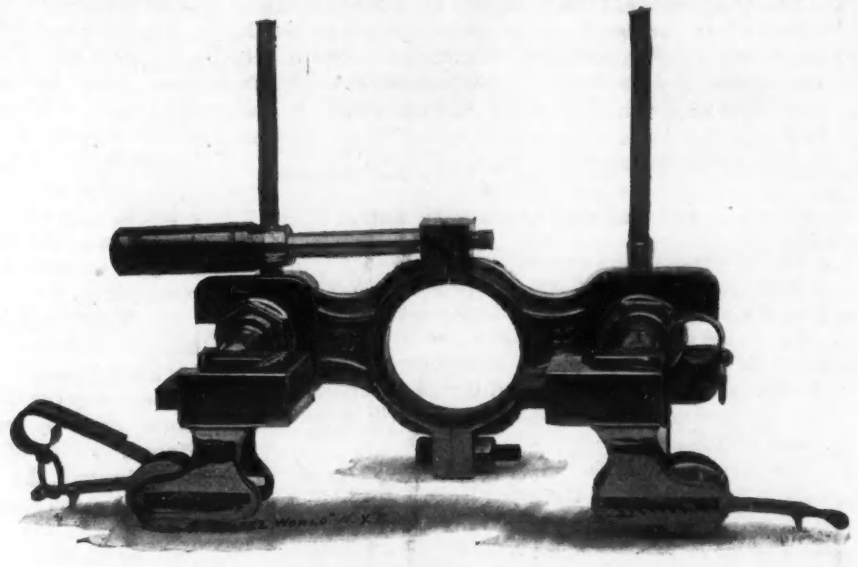
The illustration represents a duplex boiler feed pump of medium size, in which the manufacturers have made many improvements in the adjustability of the valve connections. The rocker shafts, rocker arms, links, crossheads, piston rods and all parts are in duplicate, one side with the other. The water valve area is larger and all parts easy of access. Other important features are noticeable in its construction, one being that the valve motion can be adjusted while the pump is in motion, thus insuring a full length of stroke under all conditions. The pump is made with especial adaptibility for boiler feeding, and pumping returns from steam heating coils, having large water valve area and perfect control over the steam valve adjustment, essential points in the successful working of a duplex pump, especially where hot water is pumped. Benjamin Eastwood of Paterson, N. J., is the manufacturer of these pumps, which are known as the "Eastwood." His New York offices are at 114 Liberty street, in charge of Mr. M. M. Moore, manager.



THE EASTWOOD DUPLEX STEAM PUMP.

The Benton Automatic Carbon Brush Holder for Motors and Dynamos.

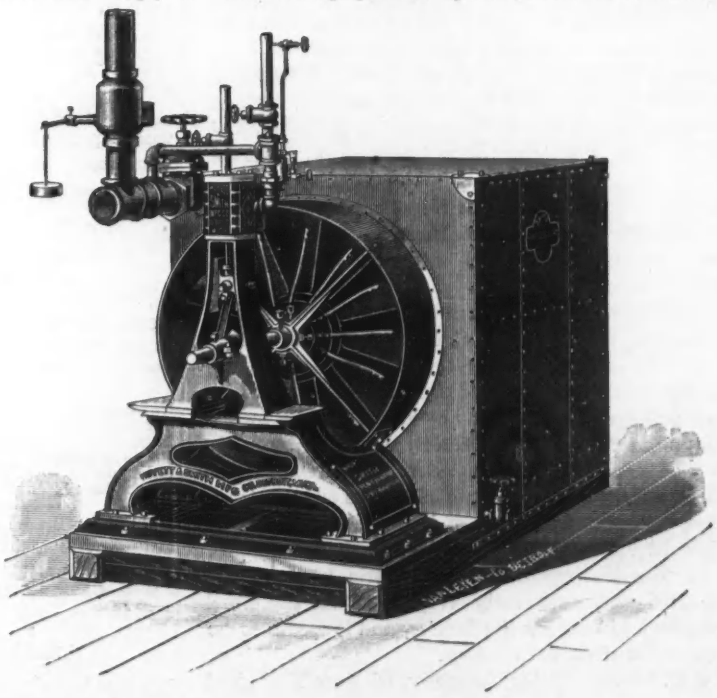
We illustrate a carbon brush holder that is on exhibition by the Detroit Electrical Works at the Pittsburgh convention. It is remarkable for its simplicity and its perfect adaptation to any motor or dynamo, and consists of but five parts, yet without a screw or a nut to work loose and fall out of place. A play of three-fourths of an inch allows adjustment in either direction when the commutator becomes worn, while the carbon brushes can be removed or replaced with a single hand while the machine is still in service, thus avoiding the possibility of a shock. The successful operation of electrical machinery depends upon just such detail appliances as this one and it is sure to meet with favor.



THE BENTON CARBON BRUSH HOLDER.

The Smith Hot Blast Apparatus.

Appreciating the importance of having a dry and even temperature in their car pits, car barns and shops and other rooms, the Union Depot Street Railway Company, of St. Louis, operating over 50 cars of the Thomson-Houston system, has utilized the exhaust steam from its engines in heating these various apartments. But instead of running miles of pipes along the sides of the walls and across the ceilings they secured one of Smith's hot blast machines containing 12,000 lineal feet of one-inch pipe and an exhaust fan capable of delivering 60,000 cubic feet of heated air per minute. This heater, illustrated herewith, is built in two sections, having double sets of heaters, one section above the other, and so connected that either section can be used for live or exhaust steam, or both sections for either. Two of the special features are that there is a constant supply of fresh air changed every ten minutes or at will, and that the steam apparatus of the entire building or buildings is all under control at one point in the engine room. The Huyett & Smith Manufacturing Company, of Detroit, has also placed one of these heaters for the West Side Street RailwayCompany in Milwaukee.



SMITH HOT BLAST APPARATUS.

New York Car Wheel Works.

The exhibit made by the New York Car Wheel Works at the Monongahela House is undoubtedly one of the finest and most interesting of any at the Pittsburgh convention. All the leading standard types of wheels and axles are shown: Thomson-Houston, Edison, Bemis, Sprague, Brill, etc. The exhibit made by this company at the Buffalo convention last October was especially and most favorably noticed by all the railroad men, and the exhibit at Pittsburgh was intended to surpass the previous one in all details.

The standard of the work done by this company is in many respects beyond the requirements of ordinary street railways. Still, in view of the wide introduction of electrical power, every railway should consider the renewal of equipment of every kind with a view to procuring material which would be most suitable for the new order of things if they should adopt it.

The average street car wheel has heretofore been of light section, has been used as it came from the foundry without further preparation than boring for the axle, and the axles have been made of ordinary iron or steel, the whole being fitted up without very much regard for mechanical conditions. All this has to be changed when electricity comes in. The weight of cars and motors requires heavier wheels and stronger axles, and the latter must be absolutely perfect in finish between the wheels to receive gears and motor mechanism. Nearly all the roads that have adopted electricity thus far have had to throw away ordinary equipment of this kind.

The New York Car Wheel Works, recognizing the demand for the best class of work, laid out and completed an entirely new series of wheel patterns in all diameters from the smallest to the largest suitable for the greater demand. After careful investigation, having made trials and tests of the best material for axles, the company arranged to furnish a special standard of cold rolled calendered steel for the purpose. These axles are guaranteed to be true to the two one-thousandths of an inch, thus insuring absolute accuracy in the fitting of gears and making them interchangeable under all cars.

The greatest improvement of all, however, is the "machined" wheel, which will be shown in the exhibit. Instead of shipping wheels as they come from the foundry, "to wear themselves true" in service, or, in other words, to rattle equipment to pieces, these wheels are taken to the machine shop, accurately bored, then placed in machines specially designed for the purpose and the treads ground absolutely true to centre. The wheels are then tested for balance, which is corrected if necessary. If it were not for the special plant put down on the most extensive scale to do this work it would add largely to the cost of finished wheels, but in connection with the large number turned out and rapid automatic working of the machinery, it is done at a cost that adds but moderately to the general expense.

In the foundry the wheels are made under the New York Car Wheel Works' system of comparative tests, which insure absolutely the quality of every wheel shipped. An evidence of the appreciation of the work of this company is afforded from the fact that the Thomson-Houston Electric Company, of Boston, Mass., after careful trial and a

most extended investigation of the processes used by the New York Car Wheel Works, adopted the work of the latter as its standard in this respect. Although the product of the company in the line of street car wheels has been on the market but for a few years, it has among its regular customers over 200 of the leading railroads in this section of the country, besides exporting wheels abroad and to the colonies. In the latter trade the wheels are used in place of the more expensive steel wheels because of the perfect finish, together with the unrivaled wearing qualities of chilled iron.

The reputation of this company as manufacturers of chilled wheels for steam railroad service runs back to the early days of railroads, and the first use of chilled wheels. In combination with the practical experience of nearly fifty years as to what will make strong, safe and durable wheels, their constant aim to attain mechanical perfection has produced a result that speaks for itself.

The Railroad Conductors' Fair.

The following notes from our special correspondent give a general description of the conductors' fair, which was held at New Haven, Conn., during the past week:

By far the most elaborate exhibit was that of the Hall Railway Signal Company, No. 50 Broadway, New York, showing a line of track protected by its different signals and wire systems, a full account of which will be published in our next issue.

The Denison Electric Engineering Company, of New Haven, Conn., which is the general agent for Connecticut for the Crocker-Wheeler perfected dynamos and motors, showed a 4-h. p. gas engine running 800 revolutions per minute, belted to a 3-h. p. Crocker-Wheeler dynamo, running four arches of lights, each arch of ten lights. The various colored globes were made by the Phœnix Manufacturing Company, New York and Pittsburgh. They also showed a ¼-h. p. Crocker-Wheeler motor running one of the Goulds triplex pumps, pumping 300 gallons of water 100 feet a minute, and a number of Crocker-Wheeler fans, in connection with which were the La Rue combination blower and a one horse Crocker-Wheeler motor, running a No. 3 Sturtevant blower. A Crocker-Wheeler $\frac{1}{16}$-h. p. motor was also in operation, running force pumps. The exhibit was very tastefully arranged and attracted much attention.

Messrs. Mackenzie & McArthur, of New Haven, Conn., showed an Underwood cotton leather belt, which was in practical operation on a gas engine, belted to a Crocker-Wheeler dynamo.

The Diamond Match Company, of New Haven, Conn., exhibited a combination dynamo and steam engine, which is best adapted for small isolated plants. This combination was running 24 lights and the whole machinery was on a base 24 × 20. In connection with this was an automatic belt adjuster which seemed to work admirably.

Messrs. N. W. & J. E. Hubinger, of New Haven, showed a combination multipolar dynamo and engine on a steel base, with an automatic electric steam governor. The armature of the dynamo is series wound. The speed is 400 and the capacity is 25 lamps. It worked very nicely indeed.

The Ramapo Wheel and Foundry Company, of Ramapo, N.Y., exhibited Snow's boltless steel tire wheel for passenger and engine service, which has given good satisfaction, and is now in use on a number of railroads throughout the country.

The Russell & Irwin Company, of New Britain, Conn., had a number of pretty exhibits of builders' hardware, including a number of novelties in the electrical line in nickel and brass.

The Ashcroft Manufacturing Company was represented by the Consolidated Safety Valve Company, of 111 Liberty street, New York. A very pretty line of steam devices was shown, including the celebrated Metropolitan automatic injector for feeding water to boilers, operated entirely by one handle; the point claimed for which is, that it is absolutely automatic and a self-contained injector. It has strong lifting qualities, is very simple and can be used as either a lifter or non-lifter without any change of jet.

The Rich Electric Heater Company, of Mt. Vernon, N. Y., had in practical operation an electric heater. The heat generated was apparently very great for the small service required to operate the heater, and it seems to be very desirable for street car heating.

The C. & C. Electric Motor Company, of New York, had a 3-h. p. motor running a 24-light Perret dynamo, furnishing light for the E. S. Greeley exhibit and Rich's electric heater. Messrs. Howard Bros., of Boston, are the New England agents for the C. & C. Company.

Messrs. E. S. Greeley & Co., of 5 and 7 Dey street, New York, showed a general line of steam railway supplies of all kinds, also a line of electric bells, magnetos, switches, cut-outs, rosettes, gong bells, telegraph relays of all descriptions, telegraph keys and batteries, a small Porter toy motor, etc. They also exhibited a line of Graham & Co.'s patent nickel and bronze car journal bearings, which are anti-friction, anti-heating and self fitting.

The Electric Connecticut Clock Company, of New Haven, Conn., had in practical operation one of its electric alarm clocks, the dial of which has 24 figures instead of 12, and rings but once in 24 hours. There is no switch to throw on at night, nor does it require any attention from one year's end to the other, except to set the alarm. The alarm will ring until it is stopped by touching the lever, so that the new alarm is sure to waken the sleeper. If the alarm is not needed, throw back the cut-off, thus giving an electrical alarm over which there is absolute control which can be used or not at will. The batteries are very powerful and made in such a way that they may be replenished at any time in the simplest manner without removing them from the case.

The Standard Electric Time Company, of New Haven, Conn., showed Warner's system of clocks, station ampère gauges, pocket battery testers, and a self-winding synchronizing clock connected with the Observatory at Yale College. The exhibit occupied 25 square feet of room and attracted great attention.

The Star Electric Company, of Bridgeport, Conn., showed a complete line of batteries, bells, cut-outs, switches, magnetos and a dynamo and motor manufactured by A. W. Whitcomb, of Worcester, Mass. This dynamo and motor is of the standard pattern and one of great efficiency. The exhibit was made to show off finely by different colored lights which were hung around in a very attractive manner.

Mr. R. T. White, Mills Building, N. Y., had a line of his well known track apparatus, including "daisy" chairs, etc., and also showed a model of his celebrated elevated railroad system.

The Union Switch and Signal Company, Swissvale, Pa., had an exhibition of Westinghouse pneumatic interlocking block signals.

The Safety Car Heating and Lighting Company, of New York, gave by printed matter a description of the Pintsch system of lighting and heating. Referring to steam heating, the advantages claimed are that it is simple, having but one steam valve and a simple trap. No adjustment of pipes or valves is required when it is desired to start a fire in the Baker heater. A fire in the heater and steam may be used to operate the system at any time, together, or either of them alone. It permits of easy regulation of the temperature of the car. Salt water is used in the circulation pipes; therefore the danger of freezing is avoided.

The Kelsey Railroad Signal Company, of Florence, Mass., had an exhibit of interlocking railroad signal appliances, one of which shown has a three-lever interlocking machine, with double wire tender and switch-lock movement and tracing point indicator with gong attachment, as in use in the Harlem tunnel.

H. A. Williams & Co., of Boston, showed a handsome line of steel and brass oilers, among which were several designed for use in central electric stations.

The Smith Friction Drill and Tool Company, 38 Oliver street, Boston, had on exhibition its combination socket wrench, drill, auger and screwdriver bit stock, which is of great value in making up and taking off nuts and bolts, as the nut or bolt-head is not released from the socket until the making up or taking off is accomplished.

The Denison Lubricator Company, of New London, Conn., has an exhibit of its lubricating compound for cooling heated journals. It is claimed that it will immediately cool a hot journal while the cars are in motion, and no journal will heat while the boxes are properly packed with it.

The Wakefield Rattan Company had an excellent assortment of car seats, used in street railway and steam railway work.

The Waddell Electrical Railroad Signal Company had a working model of the signal.

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

Chicago Quotations.—Col. S. G. Lynch, broker, 153 Monroe street, Chicago, furnishes quotations on telephone and electric light stocks as follows:

TELEPHONE STOCKS.

Chicago	$230@	$235	Cumberland	$60@	$62
Central Union	50@	51	Wisconsin	118@	120
Michigan	82@	83	Bell of Missouri	175@	180
Great Southern	30@	32	Iowa Union	20@	22
Colorado	34@	36	Missouri and Kansas	54@	56
Rocky Mountain Bell.	40@	43			

ELECTRIC LIGHT STOCKS.

Chicago Arc Light and Power	$97@	$99	Chicago Edison Co	$145@	$150

The Closing Quotations of electric stocks on Friday, Oct. 16, 1891, in New York and Boston were:

Name of Stock.	Par.	Capitalization.	Bid.	Ask'd.
NEW YORK.				
Western Union Telegraph Co	100	86,200,000	82⅛	82⅞
American Telegraph & Cable	100	14,000,000	....	80
Central and South American	100	5,000,000	....	....
Mexican	100	2,000,000	....	....
Commercial Cable Co	100	7,716,000	....	....
Postal Telegraph Cable	100	5,000,000	28	33
Edison General Electric	100	15,000,000	97½	98
Consolidated Electric Light	100	2,500,000	20	30
Edison Illuminating Co	100	4,500,000	80	81
United States Electric Light	100	1,500,000	20	25
Edison Illuminating Co., Brooklyn	100	750,000	76	80
" " " Boston	100	1,263,500	97½	102½
" " " Chicago	100	750,000	137	140
U. S. Illuminating Co	100	1,250,000	25	35
North American Phonograph Co	....	.....	1	3
New York Phonograph Co	100	6,200,000	2½	4
BOSTON.				
Thomson-Houston Electric Co	25	6,000,000	48½	49
" " preferred	25	4,000,000	26¼	26½
" " Series C	10	400,000	....	....
" " Series D	10	120,000	7¼	7½
" International Co	100	1,000,000	....	200
Thomson Welding Co	190	1,000,000	....	140
" European Welding Co	100	1,000,000	48	60
Ft. Wayne Electric Co	25	4,000,000	13⅜	13⅝
Westinghouse Electric Mfg. Co	50	5,000,000	13	13¾
Detroit Electric Works	....	.....	8¾	9
Pettengill-Andrews Co	....	.....	....	25¼
Telephone:				
American Bell	100	12,500,000	181	181½
Erie	100	4,800,000	45½	50
New England	100	10,304,600	50	....
Mexican	10	1,280,000	....	1.10
Tropical American	10	400,000	⅛	¾

NEW INCORPORATIONS.

The Colchester Electric Light Company, of Colchester, Ill., has been incorporated by J. E. Hall, M. P. Agnew and S. D. Mills, with a capital stock of $6,000.

Castle, Mont.—The Castle Street Railway Company has been incorporated, capital stock $100,000, to operate street railway lines in Castle. A. J. Davidson and others are the incorporators.

The Granite City Electric Company, of Barre, Vt., has been incorporated, with a capital stock of $40,000, for the purpose of supplying electricity for light and power. The organizers are E. L. Smith, R. S. Currer, and E. D. Blackwell.

The Citizens' Street Railway Company, of Scottdale, Pa., with a capital stock of $50,000, has been incorporated to operate an electric road in Scottdale. The promoters are A. C. Overholt, S. C. Stevenson and W. Newton Porter, all of Scottdale.

The Chartiers Valley Street Railway, of Pittsburgh, Pa., with a capital stock of $30,000, has been formed to operate an electric road in Chartiers township, Allegheny Co., Pa. Jas. T. Wood, C. C. Morrow and H. T. Friend, all of Pittsburgh, are the promoters.

The North End Passenger Railway Company, of Allegheny, Pa., with a capital stock of $200,000, has been formed to operate a cable or electric road. The incorporators are Francis J. Torrance, Wm. G. Graham and D. F. H. Stockton, all of Allegheny.

The Hero Electric Company, of Union Hill, Hudson County, N. J., has been incorporated, with a capital stock of $50,000, to manufacture and sell electric batteries and other electrical apparatus. J. H. Wood, J. B. Varick, D. P. Westerfelt and A. W. Tobey are the promoters.

Milwaukee, Wis.—The Rapid Post and Packet Company has been incorporated, capital stock $1,000,000, Warren S. Johnson president, to build a railway for rapid transmission of mail and express matter by a new motor which is neither electricity nor pneumatic tube.

Richmond, Ind.—The Early Electric Light Company, capital stock $25,000, has been recently organized by George P. Early, Charles Morris, and W. N. Gray. The company proposes to furnish incandescent electric lights, the capacity of the plant to be 2,000 16-c. p. lamps.

The Nickel Plate Street Railway Company of Scottdale, with its principal office at Mt. Pleasant, Pa., has been incorporated with a capital stock of $12,000, to operate an electric road. Joseph Herbst, Monroe Morrison and W. C. Morrison, of Mt. Pleasant, are the organizers.

St. Paul, Minn.—The St. Paul Electric and Construction Company, capital stock, $100,000, has been incorporated by Paul Martin, C. L. Haas, C. H. Lienan, J. F. Hughes and Henry Zahn, to manufacture and sell commercial electricity, dynamos, motors and dynamo-electric machinery.

The A. C. Seibold Company, of New York City, has been formed with a capital stock of $5,000, to manufacture and sell electrodes for arc lamps and other devices used in electric lamps. Albert C. Seibold, of Mt. Vernon, N. Y., and Edgar O. Clark, of New York City, are the incorporators.

The International Electric Manufacturing Company, of Chicago, Ill., has been organized with a capital stock of $100,000 to manufacture, purchase and sell mechanical and electrical apparatus and appliances, and to purchase and deal in patented inventions. John S. Filfied, Edward T. Brainerd and Thos. E. Rushbrook are the incorporators.

The Munsie-Coles Electric Railway Equipment Company, of Jersey City, N. J., with a capital stock of $50,000, has been formed for the purpose of constructing and running electric circuits for contact, either above or under ground, for railways and other purposes. The organizers are R. H. Sherwood, J. B. Campbell, T. C. Wellman, T. L. Coles, Sr., and J. F. Munsie.

The Hanson Battery Light and Power Company (incorporated in West Virginia), with its principal office in Washington, D. C., has been incorporated, with a capital stock of $1,500,000, to produce and furnish electricity for light and power and for all the various forms that are necessary for the public welfare. Walter Hanson, Luke Strider and Frank Aldrich are the incorporators.

The Butler Electric Light and Gas Company, of Butler, Mo., has been formed, with a capital stock of $15,000, to buy, own and control material, machinery, devices and appliances for manufacturing gas and electricity for lights, illumination, etc. Arthur L. McBride, Thos. W. Legg, Thos. W. Silvers, Geo. W. Canterbury, and John A. Keller are the incorporators.

The Franklin Electric Company (incorporated in West Virginia), with its principal office in New York, has been incorporated, with a capital stock of $5,000,000, to manufacture, sell, lease, etc., accumulators, primary and secondary batteries, motors and machines for light, heat and power by electricity. Geo. B. Waterhouse, of Passaic, N. J.; F. K. Irving, of Brooklyn, N. Y., and H. M. Mansell, of New York City, are the promoters.

Buffalo, N. Y.—The Cataract Electric Company, capital stock $40,000, with right to increase to $1,000,000, had been incorporated to receive electricity generated by the Niagara Power Company, at Niagara Falls, to be distributed to consumers in the city of Buffalo. The parties interested are Charles A. Sweet, Edmund Hayes, Jewett M. Richmond, J. Adam Lautz, P. H. Griffin, William Hamlin, Franklin D. Locke, H. L. Taylor, John Satterfield, S. J. McWilliams, John N. Scatcherd and Charles G. Curtiss. Edmund Hays has been elected president and Jewett M. Richmond treasurer.

AFFAIRS OF THE COMPANIES.

Boston, Mass.—The Citizens' Electric Light Company has given a quit claim deed to the Boston Electric Light Company, for property in East Boston.

A Change in the Board of Directors, of the Ashland, Centralia, Pa., Electric Railway Company was made recently by the resignation of M. T. Donahue and Frank McDonald. Messrs. Thomas Pepper and Wm. McMurtrie have been elected in their place.

Baltimore, Md.—It is reported that $500,000 of Western Union telegraph stock owned by the Baltimore & Ohio has been sold back to Jay Gould. It is stated that the negotiations for the purchase were started nearly a year ago, and that the price paid for the transfer was nearly $90 per share. It is believed that the sale will result in an extra dividend upon Western Union.

The United Electric Light Company, Springfield, Mass., at its recent annual meeting, elected the following directors: Elisha Morgan, L. J. Powers, H. J. Beebe, A. B. Wallace, John Olmsted, E. C. Rogers and C. A. Nicols. W. N. Lincoln was elected Secretary and treasurer. Henry S. Anderson, superintendent of the electric plant, was elected manager.

Boston, Mass.—At a recent meeting of the stockholders of the Edison Phonographic Toy Manufacturing Company, President

Stevens tendered his resignation, which was not accepted. It is stated that the company has no funds in the treasury, and that directors desire to be relieved from their trust. Edison is reported as having a claim for $75,000 against the company, which has spent $50,000 for heads, arms and legs for dolls, and has attachments for $25,000 against material already manufactured.

The Western Union Telegraph Company in its annual report for the year ended June 30, 1891, shows gross earnings $23,034,326, increase $647,298; net earnings $6,605,584, decrease $707,141; interest and sinking fund $931,219, increase $16,084; balance $5,674,365, decrease $723,225; dividends $4,309,607, decrease $646,401; surplus $1,364,758, decrease $76,824; total surplus $11,417,741, increase $1,364,758. Miles of poles 187,981, increase 4,064; miles of wires 715,591, increase 36,594; messages sent 59,148,343, increase 3,269,581. The capital stock is unchanged. Net bonded debt $14,801,364, increase $21,836. Gross revenue from messages shows an increase of $1,240,622; $2,500,627 being charged by the company to operating expenses for reconstruction and maintenance of lines. The general balance sheet shows: Gross floating debt $2,815,152; cash $857,422; accounts receivable $2,129,855. Cost of repairs on Dey street building $358,062; real estate valuation $2,903,918; supplies $320,231; securities of leased telegraph companies $8,182,309; stocks of other companies $7,599,312. Valuation of plant, $96,745,391. The uncapitalized surplus put into the property, $13,015,925.

The first annual statement of the United Electric Securities Company to July 31, 1891, is as follows:

ASSETS.

Stocks and bonds	$959,800	
Cash, secured notes and cash investments at cost	153,705	
		$1,113,505
First mortgage bonds, at par value, deposited with American Loan & Trust Company to secure first series collateral trust five per cent bonds		431,500
To secure second series		606,000
Accounts receivable		3,568
Cash and accrued interest		29,009
Total		2,183,582

LIABILITIES.

Capital stock		$1,000,000
Collateral trust five per cent 30-year bonds:		
First series dated Aug. 1, 1890		310,000
Second series dated Aug. 1		476,000
Stocks, bonds, notes and cash in excess of capital stock	$113,505	
Reserve of 20 per cent. of first mortgage bonds deposited to secure collateral trust 5s	207,500	
		321,005
Guarantee fund		26,577
Surplus		50,000
		$2,183,582

Special Correspondence.

NEW YORK NOTES.

Office of The Electrical World,
167-177 Times Building, New York, Oct. 19, 1891.

A Wenstrom Direct Current Dynamo of 450 lights capacity has been shipped to Montreal for an isolated plant. Mr. Benjamin Blum, of New York, secured the order.

Prospect Park Lights.—The commissioners of Prospect Park have decided to place 100 additional electric lights in the park, and have placed the order for the lamps at $22 each.

The Police Board at a recent meeting voted to ask the Board of Estimate and Apportionment for $100,000 for an electric signaling system, and $75,000 for an improved telegraph system.

The Engineering Equipment Company has leased for a term of years the handsome store premises next the main entrance of the Central Building, No. 143 Liberty street, New York, with offices located on the second floor. By this move additional stock room is secured for Underwood cotton, leather and other belting specialties. The Boston offices and salesrooms of the company are at 126 Pearl street, with Mr. F. A. Magee in charge.

H. Ward Leonard & Company report that subscriptions for electrical intelligence are coming in in a very satisfactory manner, owners of central stations and isolated plants seeming to appreciate the advantages to be derived by securing electrical information at moderate rates. Quite a large number of supply houses and electrical manufacturing companies are among the subscribers, special rates being made for information such as is called for by the latter.

American Institute of Electrical Engineers.—The sixtieth meeting of the Institute will be held at 12 West Thirty-first street, New York, Tuesday evening, Oct. 27, at 8 o'clock. A paper will be read by Mr. A. E. Kennelly on "Magnetic Reluctance." The paper announced for this meeting by Mr. H. Ward Leonard has been postponed until further notice. In accordance with a vote at the previous meeting, the discussion on Prof. Harris J. Ryan's paper will be continued. If time permits, the report of the Committee on Units and Standards will also be taken up. Members who are especially interested in these subjects may secure advance copies upon application to the secretary, which will be forwarded at the earliest possible moment. L. H. H.

NEW ENGLAND NOTES.

Branch Office of The Electrical World,
Room 28, Hathaway Building, 620 Atlantic Ave.,
Boston, Mass., Oct. 17, 1891.

Thomson-Houston Sales.—It is stated that the September sales of the Thomson-Houston Electric Company amounted to $1,200,000.

To Be Consolidated.—It is reported that the electric light plants at Whitman, Abingdon and Rockland, Mass., are to be consolidated.

North Abingdon, Mass.—The plant of the North Abingdon, Mass., Electric Light Company, it is expected, will be in running order by Dec. 1.

Malden, Mass.—The East Middlesex Howe Railway Company has petitioned the board of aldermen for the right to erect poles for the purpose of running its cars by electricity, and it was voted to give the company a hearing Tuesday evening ct. 20. C. A. B.

WESTERN NOTES

Kansas City, Mo., Oct. 16, 1891.

Joplin, Mo., is figuring on an arc and incandescent light plant.

The Franklin Electric Company has a very creditable display at the Interstate Exposition.

Mr. W. E. Irish, of Cleveland, O., has been in Chicago this week arranging for the manufacture of his magazine arc lamp.

Mr. B. E. Sunny, general western manager of the Thomson-Houston Electric Company, returned to Chicago from San Francisco this week.

Mr. Charles E. Bibber, general manager of the Consolidated Electric Manufacturing Company, of Boston, was a welcome visitor in Chicago.

Mr. James R. Dee, general manager of the Peninsula Electric Light and Power Company, of Houghton, Mich., was in Chicago this week purchasing supplies for an extension to his already large plant.

Mr. Harry Lawrence, of the Midland Electric Company, of Denver, Col., purchased a supply of machine tools in Chicago this week, to enable his company to extend its manufacturing facilities.

Metcalf, Lawrence & Co., of Denver, Col., have placed a device on the market for dimming the light from continuous or alternating current lamps, by which the required quantity of light is afforded.

Mr. W. H. McKinlock, of Chicago, president of the Gate City Electric Company, and also of the Southern Electric Company, of St. Louis, Mo., was in the city last week on a business trip, that will include the principal Western cities.

The Missouri & Kansas Telephone Company is trying to secure a new contract with St. Joseph for fire and police alarm systems. A large amount of new construction will be needed, necessitating a heavy outlay. To meet this the company has raised its rates for telephone service from $25 to $35 per year.

Milwaukee, Wis.—The second annual banquet of the Wisconsin Electric Club was held at the Plankinton House recently, which was attended by about sixty members and invited guests. An elaborate menu was served, and addresses were given by prominent speakers from the city and out of town on electrical and mechanical subjects.

Mr. Henry B. Stone, president of the Chicago Telephone Company, has been elected a director of the World's Fair, to succeed Mr. Jeffrey. Mr. Stone was vice-president and general manager of the Chicago, Burlington & Quincy Railroad at the time of the "Q strike," and his conduct at that time won him a host of friends among the best class of citizens. Mr. Stone will be a valuable addition to the board and a friend to the electrical department.

F. De L.

Answers to Correspondents.

Questions to be answered in this column must be of general electrical interest, and must be accompanied by real name and address as a guarantee of good faith. No notice will be taken of questions regarding apparatus unless enough details are given to permit a definite answer, and no dynamo or motor designing will be done.

Alternating Motors.—Can a small fan motor of good laminated field and armature series wound for 50 volts direct current and of one-eighth h. p. capacity, be made to run on a 50-volt alternating circuit? F. B. W.

Yes, but not very efficiently. It depends somewhat on the motor, but such a machine can always be arranged to run on an alternating circuit. Its use, however, is not in general satisfactory

Carbon Brushes.—Will you inform me whether it would be practicable to substitute carbon brushes for the copper brushes now in use on an 18-light Brush arc machine? H. B. C.

We would not advise you to try carbon brushes on a dynamo of the type you mention, for while it might be reasonably successful, there would be danger of chipping the brushes, causing short circuits between the segments.

Street Railway Motors.—I have two street railway motors on one truck; when they run separately they develop equal power, when thrown in together one motor is dead, always the same one; everything tested out correctly. Can you give the cause of the trouble? C. E. P.

It looks as though your difficulty was caused by improper coupling of the two motors, but without knowing the kind of motor, or any of the details, it is impossible to give a definite answer. You would do well to look over the connections and see that when both motors are thrown in they are really in parallel, so that the current must flow through both.

News of the Week.

THE TELEPHONE.

Telephone Communication between La Grange, Mo.; Monticello, Canton, Lewistown, La Belle and Williamstown, is being agitated.

A Telephone Line, connecting Big Timber, Mont., and Melville, is being constructed by H. O. Hickox and Busha & Bailey, promoters of the line.

Gormania, W. Va.—The Gormania and Medley Telephone Company has been organized, and will build a telephone line from Gormania to Medley. The capital stock is $5,000.

Telephone Suit.—The hearing in the Lowell, Mass., telephone suit, which was to have been held in Boston, was postponed recently, by agreement of the interested parties, to some future date not yet agreed upon.

THE ELECTRIC LIGHT.

Havana, Ill., is to have electric lights.

Fulda, Minn., is agitating electric lighting.

Orrville, O., is to have an electric light plant.

Russellville, Ark.—Citizens are discussing electric lighting.

Carthage, Ill., is to have an electric light plant, to cost $15,000.

Kentville, N. S.—The town will soon be lighted by electricity.

Manson, Ia.—The city has contracted for an electric lighting plant.

Morris, Minn.—The electric lighting question is being agitated.

Elberton, Ga.—The question of electric lighting is being considered.

Leslie, Mich.—An electric light plant to cost $10,000 is to be erected.

Morris, Ill.—The electric light plant, recently completed, is in operation.

Jefferson Ia.—Citizens are considering putting in an electric light plant.

Grand Haven, Mich.—The city will have electric lights early in November.

Rockford, Ill.—The Barnes machine shop is lighted by 60 new electric lights.

El Paso, Ill.—The contract has been let for an electric light plant for the city.

Canton, S. D.—A company has been formed to furnish the city with electric lights.

Rockville, Ind.—A. Moore, who is interested in the electric light plant, will add a new dynamo to the plant.

Eldora, Ia.—The question of electric lighting is being considered by a committee appointed for the purpose.

Plymouth, N. H.—Work has been commenced on the electric lightplant and will be pushed to completion rapidly.

Brenham, Tex.—An electric light plant will be established. It is reported that William Axet is behind the enterprise.

Carthage, Mo.—The Carthage Electric Light and Power Company has recently installed new machinery in its plant.

Edgerton, Wis.—The Common Council has granted a franchise to a local company for the erection of an electric light plant.

Niles, O.—By a recent vote of the City Council it was decided to add a Phœnix engine, 90 h. p., to the city electric light plant.

Waynesboro, Va.—An electric light plant will be erected by the Waynesboro Street Railway, Light and Water Company.

Middletown, Conn.—An electric plant is to be installed in the factory of I. E. Palmer by the Schuyler Electric Company.

Albany, Mo.—The city is receiving bids for electric lighting through W. R. Staton, city clerk; J. B. Kingsborough, mayor.

Boston, Mass.—The Weston Illuminating Company has deeded property on Stanhope street to the Boston Electric Light Company.

Racine, Wis.—The Badger Electric Company is supplying 150 new street lights. A new engine has recently been added to the plant.

Santa Fe, N. M.—The Santa Fe Electric Company, at a recent meeting of its stockholders, considered increasing the capacity of its plant.

Anacortes, Wash.—An electric light plant is to be erected of a capacity sufficient to light the city, business houses and private residences.

West Troy, N. Y.—The village clerk has been directed to advertise for a new dynamo and twelve 2,000-c. p. lamps for the electric light station.

Irwin, Pa.—The power house for the new electric lighting plant is nearly completed, and it is expected that the town will be lighted within the month.

Taylorville, Ill.—The Taylorville Electric Company is erecting new buildings, will put in a new 150-h. p. boiler, and duplicate its electric apparatus.

Homer, Mich.—The town is to have electric lights. The Leslie Electric Light and Power Company has been organized, with W. Johnson, president.

Aspen, Col.—The Roaring Fork Electric Light and Power Company is erecting an addition to its plant and contemplates putting in a 250-h. p. engine.

Leavenworth, Kan.—The stockholders of the new Merchants' Electric Light Company at a recent meeting voted to push matters in erecting the plant.

Abington, Mass.—The Abington & Rockland Electric Light and Power Company, capital stock $30,000, expects to have its plant in operation by Dec. 1.

Manchester, N. H.—The Manchester Electric Light Company is furnishing current for motors and an incandescent service either by meter or on contract.

Savannah, Mo.—The question of issuing $12,000 of bonds for an electric lighting plant, to be operated by the city, is to be submitted to a vote of the citizens.

Niles, O.—The Schuyler Electric Company is to install the electric lighting plant for $7,290, the work to be completed within 40 days from date of contract.

Lebanon, Pa.—The Lebanon Match Company has contracted with the Edison General Electric Company of New York for an electric light plant in its factory.

Butte, Mont.—It is stated that there is a possibility of the consolidation of the Butte Electric Light and Power Company and the Silver Bow Electric Light Company.

Kaukana, Wis.—John Schulthies has purchased of Messrs. John Earles and Tanner Bros. their interest in the Kaukana electric light plant; consideration, $4,000.

Greenville, Pa.—The Edison General Electric Company has been awarded the contract for putting in the electric light plant at Greenville, after a sharp competition.

Waupaca, Wis.—The contract for lighting the Wisconsin Veterans' Home has been let to the Milwaukee Edison Light Company, the plant and fixtures to cost $4,400.

Marquette, Mich.—The Common Council at a recent meeting passed an ordinance to abolish the Electric Light Commission, the city to take control of the lighting service.

Glenwood, Ia.—The question of granting an electric light franchise to J. D. Paddock, L. W. Boehner and their associates is to be voted upon at a special election on Nov. 3.

Hammond, Ill.—The council committee on electric lighting has been inspecting central stations in Galesburg, Monmouth, Rock Island, Davenport, Moline, Peoria and Pekin.

Delaware, O.—The Delaware Electric Light and Power Company has purchased a 1,500-light incandescent dynamo and a 50-light arc machine, in order to give increased service.

Franklin, Ind.—The poles for electric lighting have been erected, the dynamos and engines put in place, and it is expected the town will be lighted by the last of the month.

Mascoutah, Ill.—E. R. Hagist, Julius Postal and John Scharth, of the Mascoutah Electric Light Company, recently incorporated, have been granted a franchise by the City Council.

Duluth, Minn.—The Edison General Electric Company has been given the contract for lighting the great Mitchell and McClure mill. There will be 40 arc and 50 incandescent lights.

The Dover and Foxcroft (Me.) Electric Light Company has decided to put in a steam plant to be located at some point beside the railroad. It is expected that it will turn on the light by Nov. 1.

Tipton, Ind.—A. S. Nickey has been awarded the contract, by the City Council, to furnish 15 electric lights for the city, at a cost of $1,050 per annum; lights to burn all night, Thomson-Houston system.

Granville, N. Y.—It is reported that $10,000 of stock has been subscribed for the erection of an electric light plant, $4,000 remaining necessary to be subscribed to assure the town electric lighting facilities.

Portland, Me.—The steamer Forest Queen, of the Casco Bay line, has received her electric light plant, and it is now in operation. There are 55 lights in all, and even the binnacle and masthead lights are electric.

DeKalb, Ill.—An ordinance has been passed by the city council, granting to S. E. Bradt and John W. Glidden, authority to erect an electric light plant, light to be furnished within six months from Oct. 31, 1891.

Waterville, Wash.—The contract for erecting the electric

light plant has been let to the Thomson-Houston company by W. R. Ballard. The capacity of the plant will be 650 incandescents and 50 arcs.

Aurora, Mo.—The action of the City Council in contracting for 20 electric lights has been ratified by special election, and as the electric light plant is completed it is expected that lights will be turned on at once.

Pontiac, Mich.—Manager Fisher, of the Speary Electric Light Company, has leased land adjacent to the city water-works for the erection of a building for the plant to light Pontiac. The work is being rapidly pushed.

Roodhouse, Ill.—It is stated that a mortgage of $2,000 against the plant of the Roodhouse Electric and Power Company has been foreclosed, and that there is a possibility that the town may be deprived of its electric lights.

Franklin, Va.—At a recent meeting of the Town Council it was decided to establish an electric light plant, to be operated under municipal control. An electric light plant is being installed in the mill of the Camp Manufacturing Company.

Fort Howard, Wis.—The Green Bay and Fort Howard Electric Light Company is extending its lines for incandescent lighting to Fort Howard and will have the service ready by December 1. A new 2,000-light dynamo has been purchased.

St. Joseph, Mo.—The city has paid a warrant for $17,668.70, the final payment due on the electric light plant, and the plant has been turned over to the city authorities on a bill of sale executed by the Excelsior Electric Light Company.

Leisenring, Pa.—The Frick company has decided to erect electric plants at Leisenring mine, No. 2, Trotter and Standard, and these mines will be equipped with electric appliances and lighted by incandescent and arc lights, it is expected, by Nov. 1.

Lyons, Kan.—The plant of the Lyons Electric Light and Power Company has been purchased by Mr. Frank Kapp, who also owns the plants at Ellsworth, Sterling and Great Bend. It is stated that an incandescent system is to be added to the plant in Lyons.

Rockford, Ill.—The City Council has authorized a contract to be made with the Rockford Electric Light and Power Company for lighting the city, the company contracting to furnish 20 lamps one year at $114 each; two years, $106 each; three years, $98 each, of 2,000 c. p.

Valdosta, Ga.—The Valdosta Electric Light and Power Company, of which Mr. M. B. Lane is president and B. W. Bentley secretary and superintendent, has a Thomson-Houston plant, supplying 25 arc lights and 500 incandescents. The company is reported in a most prosperous condition and recently paid a semi-annual dividend of six per cent.

Alameda, Cal.—At a recent meeting of the Board of Trustees a proposition was received from the Oakland Gas, Light and Heat Company to purchase the Alameda municipal electric light plant. The company also asked a franchise for an electric light and power plant for 50 years.

Little Falls, N. Y.—The contract for furnishing arc lights for street lighting has been awarded to W. F. Lansing, his bid to furnish 80 lights for 27 4-10 cents each per night having been accepted by the Town Board of Trustees. A stock company is to be organized by Mr. Lansing.

Houghton, Mich.—James R. Dee, general manager of the Peninsular Electric Light and Power Company, has engaged two expert house wiremen from Chicago, who will do the wiring for the company in private residences. This company already has a private service of 600 or 700 lights.

Chicago, Ill.—The electric light plant recently installed in the *News* building consists of two Edison dynamos. Six hundred incandescents and 80 arc lights are in use. Over 90,000 feet of wire was used in wiring the building. Five electric motors are used in running the ventilating system.

Creston, Ia.—A. H. Spurr and others interested in the People's Electric Light and Power Company, recently organized, have machinery for the plant, etc., ready to be put in place, but as yet have failed to secure a franchise from the City Council, and it is stated may be shut out altogether.

Newark, N. J.—It is stated that a new company, with a capital stock of $500,000, is soon to be organized for the purpose of erecting an electric light plant to furnish incandescent lights and power for manufacturers. Elias S. Ward, General Grubb, and the Edison Company, are said to be interested.

Pontiac, Mich., voted recently on the question of owning and controlling an electric light plant, and out of a total vote of 528, 303 were against the proposition. The Council has voted to authorize the water-works board to issue a lease of ground to the Commercial Electric Company, of Detroit, on which the latter company is to erect an electric light plant at once.

Milwaukee, Wis.—Proposals were recently submitted to the City Council by the Milwaukee Power and Lighting Company, naming conditions for erecting and maintaining an electric light plant. Four separate proposals were made, which members of the Council think the city cannot accept. It is stated that the Board of Public Works will have to readvertise for bids.

Pueblo, Col.—The new plant of the Citizens' Electric and Power Company, recently installed, has begun operations. The system is the Wood arc, capacity 800 lights, and 1,200 Slattery incandescents. The officers of the company are: J. F. Vail, president; J. A. Black, vice-president; F. H. Devine, treasurer; John W. Finlan, secretary, and J. W. Chatterton, manager.

Cleveland, O.—The Director of Public Works, R. R. Herrick, is advertising for sealed proposals for furnishing one or more masts and 128 posts or brackets, with electric light and such other electric lighting as may be directed by the city, for one year from Jan. 1, 1892; bids to be made on blanks furnished by the Director of Public Works, and delivered previous to 12 o'clock M., Nov. 4, 1891.

Geneva, Ill.—The following citizens have been appointed a committee to solicit subscriptions for erecting an electric light plant jointly for the cities of Geneva and St. Charles: On subscriptions—R. W. Sanborn, Henry Bennett and P. T. Bartholomew, of Geneva, and W. H. Wilcox, T. E. Ryan and Albert Wilson, of St. Charles; to wait on Geneva Council—C. H. Beers, M. C. Orton, Dr. F. H. Blackman, H. B. Brown, R. C. Richards.

THE ELECTRIC RAILWAY.

Du Bois, Pa.—The new electric railway is ready for service.

Bradford, Mass.—The question of an electric railroad to Lawrence is being agitated.

Boston, Mass.—The Jamaica Plain line of the West End Street Railway Company is now in operation.

McKeesport, Pa.—The White Electric Traction road, connecting this city with Duquesne, has been put in operation.

Gadsden, Ala.—The Gadsden and Attalla Union Railway Company has decided to change its dummy system to an electric.

Cleveland, O.—The Woodland and West Side Street Railroad Company has increased its capital stock from $1,100,000 to $2,000,000.

Baltimore, Md.—The contract for building the North Avenue Electrical Railroad has been awarded to E. D. Smith & Son, of Baltimore.

Ottawa, Can.—The directors of the Ottawa Street Railway Company met recently to consider the question of using electricity in place of horse power.

Shelby, N. C.—A proposition to build an electric railway from Shelby to Cleveland Springs, for the transportation of passengers and freight, is being considered.

Lawrence, Mass.—The lines of the Merrimack Valley Street Railway Company are nearly all equipped with electricity, and the company has sold its horses at auction sale.

Los Gatos, Cal.—F. Chappelet and H. de Laguna have petitioned the Town Board for a franchise for an electric road to connect with the Haynaut and San Jose lines.

Napa, Cal.—San Francisco capitalists are considering the construction of an electric railroad from Napa to Calistoga, a distance of 28 miles, to carry freight and passengers.

Greensburgh, Pa.—The lines of the Greensburgh and Hempfield Electric Street Railway are being extended to Jeannette, and it is stated that the lines may be extended, in time, to Pittsburgh.

Biddeford, Me.—The work of equipping the lines of the Biddeford and Saco street railway as an electric system has been commenced, the company, it is stated, attending to its own construction.

Hopkinsville, Ky.—A franchise has been secured by the Thomson-Houston Electric Company, of Cincinnati, O., to build an electric street railway in Hopkinsville. It is reported that a $75,000 plant will be built.

Edwardsville, Pa.—At a recent meeting of the City Council it was voted, 4 to 2, to grant a permit to the Wyoming Valley Traction Company to build its lines through the streets of the town, subject to certain conditions.

Beverly, Mass.—At a recent meeting, held for the purpose of considering the practicability of allowing the Naumkeag Street Railway Company to equip its road with the trolley system, it was voted not to grant a permit, the vote standing 299 to 240.

Montreal, Can.—It is expected that the electric roads by-law will be passed by the board of aldermen, and that the road committee will give the electric railway company permission to begin work, and that the road will be completed and cars running by July 1, 1892.

Ashland, Pa.—Mr. John F. Finney, general manager of the New Shenandoah, Mahanoy City, Girardville and Ashland (Electric) Railway Company, and A. H. Chadbourne, an electrical expert, recently located the site for the power house on the Girard estate, at Girardville.

Milwaukee, Wis.—It is reported that the Villard syndicate has an option on the West Side street railway system, known as Washington Becker's electric road. If the sale is consummated, the Villard syndicate will practically own the entire street railway system of Milwaukee.

Chartiers, Pa.—A charter has been granted the Chartiers Valley Electric Street Railway Company; capital stock, $30,000. The directors of the company are James T. Wood, of Pittsburgh; James W. Friend, of Allegheny; Harry T. Friend and Charles C. Morrow, of Pittsburgh, and George B. Motheral, of Allegheny. The road will be five miles long.

Scottdale, Pa.—A charter has been issued to the Scottdale, Everson and Broad Fork Street Railway Company; capital stock, $30,000; length, five miles. The directors are Nathaniel Miles, A. C. Overholt, J. D. Hill, George H. Tewell, B. F. Overholt and E. A. Humphries, of Scottdale; John R. Byrne, Peter Wise and Adam Brown, Everson.

Birmingham, Ala.—The Birmingham Railway and Electric Company has placed its new electric system in successful operation. It is stated that alterations in the lines already made cost $300,000, while $300,000 additional will be spent to complete necessary changes in equipment, etc. The changes already made embrace the addition of twenty-four new coaches, twelve miles of steel rails, fifty miles of wire, three miles of poles, and ten months employment for 500 employés.

Hawaiian Tramways.—The London *Electrical Engineer* says: "At the fourth general meeting of the Hawaiian Tramways Company, the chairman, Col. C. M. Davidson, stated that with a view to the future an act had been obtained from the Hawaiian government giving the company power to use electricity, which was expected to prove of great advantage. At present their horse system costs 4.46d. a mile. The London office of the company is 301 Camberwell road."

Sioux City, Ia.—A trial of the Bradbury-Stone storage battery car was made recently over the Riverside street railway lines. The car used weighed 12,000 pounds, and was properly loaded for the test, which was made in the presence of the following gentlemen, who were present by special invitation from Mr. Bradbury, the inventor: W. F. Weyburn, J. T. Bradbury, E. B. Spaulding, W. E. Higman, W. W. Byam, F. F. Byron, Mr. Mack, electrician of the cable road; W. Kramer, E. M. Dunbar, and others interested in the new company which has been formed to manufacture the storage batteries. The test is reported as very satisfactory, an actual speed of sixteen miles an hour having been shown, the car being perfectly under control. Another trial will be made soon over the lines of the cable railway.

GENERAL APPLICATIONS OF POWER.

Philipsburgh, Mont.—The Flint Creek Electric Power Company, capital stock $25,000, has been incorporated by T. F. Baker and Joseph H. Harper, of Butte, and A. J. Bennett, of Virginia City, for the purpose of utilizing the power of Flint Creek Falls, for developing and transmitting electrical energy to Philipsburgh, Granite, Rumsey, Black Pine, Georgetown, Pyrenees, Cable and Anaconda.

A Mammoth Project is being agitated at Athens, Ga., and plans are reported as being matured, for running the machinery of every manufactory in the city by electricity. A company composed of Atlanta capitalists is negotiating to secure control of water power of 10,000 h. p. at Barnett Shoals, and if successful a company will be formed and a mammoth plant will be erected at the place, where the electricity will be generated for transmission to Athens for power purposes.

Pueblo, Col.—A $500,000 electric smelting plant will soon be in operation here. Negotiations are pending between American and English capitalists for the formation of a company capitalized at $2,000,000, of which $500,000 will be subscribed immediately; $300,000 of which will be put into the plant at once and $200,000 reserved for an operating fund. The works will be intended especially for the reduction by electricity of dry and refractory ores, although all kinds can be handled. The capacity will be about 200 tons a day. At least 200 men will be employed.

St. Louis, Mo.—Until recently central station companies supplying power in this city have refused to furnish power for motors other than those sold by them or which they were agents for. Mr. James I. Ayer, of the Municipal Electric Light and Power Company, has recently announced that, having increased the facilities for furnishing power, his company from now on will supply power for motors of any manufacture, up to 500 volts. The Municipal Electric Light and Power Company has one of the largest plants in St. Louis and is the first to inaugurate the change as above.

PERSONALS.

Mr. J. Smith has been appointed engineer of the Flushing (N. Y.) Electric Light and Power Company.

Mr. Charles Clevenger, of Albany, Ore., is to have charge of the electric light plant at Roseburgh, Ore., acting as electrician for the company.

Mr. George Bacon, formerly with the Scranton, Pa., Electric Light and Heat Company, has assumed the management of an electric light plant in Cleveland, Ohio.

Mr. John C. Keefe has resigned as secretary of the Syracuse (N. Y.) Electric Light and Power Company, and Mr. M. C. Palmer is acting as secretary in his place.

Mr. W. S. Jackson, formerly superintendent of the Madison (Wis.) Electric Company, is soon to be established in Chicago under the firm name of the Jackson-Cornish Electric Company.

Mr. L. K. Perot, until recently with the Thomson-Houston company, has been appointed assistant engineer of the Equitable Engineering and Construction Company, of Philadelphia, Pa.

Mr. Wm. Porter, mechanical engineer, formerly general manager of the Chester Foundry and Machine Company, has recently accepted an offer from the Wheeler Condenser and Engineering Company, 92 Liberty street, New York.

Mr. W. E. Bolleau, superintendent of the Brush Electric Light and Power Company, Columbus, Ga., has recently returned from his wedding trip, having been married on Sept. 23 to Miss Eloise Hubbs at Hammondsport, N. Y.

Mr. H. K. Marvell has severed his connection with the Perkins Electric Lamp Company, of Manchester, Conn. His farewell visit to the factory last week was made the occasion of the presentation of a gold-headed cane, a token of respect from the employés of the company.

LEGAL NOTES.

Middleborough, Mass.—A petition has been filed in the Supreme Court for the dissolution of the Middleborough (Mass.) Light and Power Company.

The Louisiana Electric Light Company, New Orleans, La., has recently issued a circular letter to its patrons and the public, to the effect that it will protect its patrons and stand by them against any attack made by the Edison Electric Illuminating Company as a result of the recent decision of the Federal Court, sustaining the priority of the Edison patents.

The Edison Electric Illuminating Company and the Shamokin Arc Light Company, Shamokin, Pa., are engaged in a legal controversy, the former recently having had a notice served on the latter to appear before Judge Rockefeller at Sunbury to show cause why a preliminary injunction should not be issued to restrain them from continuing to place their wires on the posts they have now erected, claiming that it will interfere with and make more hazardous the operating of the former's lines, on account of their close proximity.

The Ninth Avenue Railroad Company, New York, Oct. 14 obtained an injunction to stop the sale of the road by Comptroller Myers, in satisfaction of a claim of the city, on a judgment obtained Aug. 16, 1861, against the company for $8,045.09, for paving done from Forty-fifth to Fifty-third street. For some reason the judgment has been allowed to rest for thirty years, and the money has never been paid into the city treasury. Recently Comptroller Myers took steps to collect the judgment, and was contemplating selling the road, but is stopped for the present by the injunction.

Mr. C. J. Helm, representing the Suburban Electric Heat Light and Power Company, Newport, Ky., with which that city has contracted for city lighting, recently made application to the Court of Appeals for a rule against the officials of the Newport Light Company and John A. Williamson, president, individually, to show cause why they should not be attached and punished for contempt of court in violating the supersedeas bond which was given before the Clerk of the Court of Appeals, in the appeal taken from the order of Judge Toney, of the Law and Equity Court, of Louisville. Affidavits in support of the motion were filed, and the court took the matter under advisement.

Injunction Granted and Suspended.—Judge Alfred C. Coxe recently granted to the Brush Electric Company a writ of perpetual injunction restraining the Electrical Accumulator Company, Theodore R. Vail and O. E. Madden from a claimed infringement on letters patent granted to Charles J. Brush. Judge Lacombe, Oct. 14, suspended the writ of perpetual injunction for thirty days, with leave to defendants to apply for a further suspension, or for the vacation of said injunction in case it should appear to the court that the complainant or its lessees, the Consolidated Electric Storage Company, are not prepared to deliver to defendant or its customers the types of battery made by the Accumulator company at the prices named in the affidavit of Mr. Bracken filed on the hearing of the motion.

Industrial and Trade Notes.

The Electric Construction and Supply Company, 18 Cortlandt street, New York, received an order for 600 Ward arc lamps last week.

The Electrical Supply Company, of Chicago, the Western agent for the Anderson "Boston" trolley, reports a very encouraging demand for these trolleys from its customers.

Dissolution of Partnership.—The firm of Bartholomew & Peckham, of 18 Spruce street, New York, has been dissolved by mutual consent, William H. Bartholomew continuing the business at the same address.

The Huyett & Smith Manufacturing Company, of Detroit, distributed circulars at the Pittsburgh convention, illustrating the hot-blast apparatus in use by the Union Depot Street Railway Company, of St. Louis, Mo.

Reduction in Wages.—The glass blowers in the Edison Electric Lamp Works, in Harrison, N. J., have been informed of a reduction of 25 per cent. to be made in their wages. The pay has been 45 cents per 100 bulbs.

The Bryant Electric Company, of Bridgeport, Ct., has recently attracted the attention of the electrical trade by bringing into the market a new 5 and 10 ampère single pole switch. The company has added to its specialties Edison and Sawyer-Man main and branch blocks.

The Electric Merchandise Company, Chicago, Ill., is represented at the American Street Railway Association, in Pittsburgh, with headquarters in Parlor 5 at the Monongahela House. The company extends a cordial invitation to its friends to visit it headquarters during the convention.

The Mason Regulator Company, of Boston, manufacturer of steam regulating devices, has been sending its patrons a neat little advertising card, representing a typewriter singing Little Annie Rooney, "merrily singing, while hammering away acknowledging orders" sent to the company for its steam devices.

The Western Electric Company, 227 South Clinton street Chicago, Ill., has recently issued for the trade an illustrated general catalogue of 300 pages, devoted to prices and descriptive illustrations of the various specialties manufactured by the company. The catalogue is issued in convenient form for ready reference.

The Union Porcelain Works, of Brooklyn, N. Y., has sent out an illustrated catalogue of hard porcelain insulators and electric fittings which it manufactures. This company has had 27 years' experience in the business, and the output of its factory comprises a large list of porcelain products. Special goods are also made to order.

The Hunt Engineering Company has removed its offices from 238 Washington street, Brooklyn, to 126 Liberty street, New York. This move has been contemplated for some time, owing to the fact that the property which the company occupied in Brooklyn has been acquired by the Brooklyn Bridge trustees for terminal purposes.

The H. Ward Leonard & Company now have on exhibition at their offices in the Electrical Exchange Building, 136 Liberty street, New York, a Crocker-Wheeler motor, operating under Mr. Leonard's new principle for controlling the speed, torque and direction of rotation of motors, showing the principle used and the facility with which the speed or torque is controlled.

The Detroit Electrical Works are now in a position to supply generators to street railway companies as rapidly as they may be called for, having largely added to their facilities in this line. They are shipping several 80,000-watt generators this week that are handsomely finished and perfect in all the details, having commutators of tempered copper and Benton's patent carbon brush holders.

The Delaware Iron Company, owned and operated by Morris, Tasker & Co., of New Castle, Del., has decided to rebuild its plant, which was lately destroyed by fire, and has placed the contract with the Berlin Iron Bridge Company, of East Berlin, Conn., for the entire plant, which will be constructed of iron from the designs of the Berlin company. The work has to be completed by Dec. 1.

The American Electric Supply Company, of Buffalo, N. Y., has been given the contract for the electric work of the New Erie County Savings Bank. The work will cost nearly $20,000, and it is stated that the plant will be one of the most complete isolated plants in the country, consisting of three engines and three dynamos, with a capacity of 2,500 lights. The interior conduit wiring system is to be used.

The Crocker-Wheeler Motor Company has placed Mr. D. Herbert Jeffrey, formerly general manager of Jeffrey & Co., Jersey City, N.J., in charge of its New York offices. Mr. Jeffrey will have charge of all correspondence, the management of records and details of office matters, relieving officers of the company, so that each may devote more attention to the requirements of the various departments of the business.

The Standard Railway System of the Detroit Electrical Works, of Detroit, Mich., is explained and illustrated in several advance pages of a new catalogue received by us recently. Facts in regard to electric traction and the advantages of the Rae system of street railway motors are presented for the consideration of the reader in a business-like and intelligent manner. The catalogue will soon be ready for distribution.

The Crocker-Wheeler Motor Company has recently added Mr. Thomas J. Fay to its already large electrical staff. This gentleman brings with him an extensive experience gained by a previous connection with the Edison, Thomson-Houston and other prominent electrical companies, which will be of considerable value in his present work. Mr. Fay will have charge of the testing department, the force of which the company has lately increased.

The Jordan Electric Lighting System, for steam and street railways, the invention of L. F. Jordan, of Boston, is being manufactured by the B. G. Electrical Supply Company, of Portland, Me. The system comprises couplers, guides and switches, which enables the "trailer" to be lighted as well as the motor. It has many features, practical and labor-saving. The company also manufactures all kinds of molded electrical supplies and specialties from "Duralite."

The McCreary Electrical Specialty Company, manufacturers of reflectors and electrical specialties, 136 Liberty street, New York, in an illustrated price list recently issued, presents to the trade a complete list of patented specialties manufactured and controlled by the company, particularly those adapted for incandescent electric lighting. The price lists and illustrations are arranged in a form convenient for the use of patrons and are published to take the place of former issues.

An Advance Copy of a sequel to "Kind Words," to be issued by the engineering department of the Fort Wayne Electric Company, shows a collection of about 70 letters, written to the company by patrons who are using the Wood arc lighting and Slattery incandescent apparatus manfactured by this company. The compilation has been made by W. J. Morrison, of Buffalo, N. Y., general agent of the company for New York State and Canada, all the letters shown being fac simile reproductions. They make interesting reading, and will be used to advantage when the publication "Kind Words" is ready for distribution.

Common Sense for the consideration of proprietors of steam plants in the making and using steam, is the caption of a treatise on the subject published by The Mason Regulator Company, of Boston, Mass. Advance copies of this publication recently received by THE ELECTRICAL WORLD present in an interesting and instructive form a compilation of valuable facts worthy of consideration on the part of those interested in steam engineering. It is from the pen of William Harrison Bailey, M. E., of Rochester, N. Y., who has handled the subject in a practical manner, stating concisely the knowledge gained by "one who has paid for his experience."

The First Elevator to be operated upon the new principle invented by Mr. H. Ward Leonard was tested recently in Brooklyn, and the result is reported as very satisfactory. The elevator is that in the central station of the Edison Electric Illuminating Company. The operation of the elevator is controlled entirely by the movement of a handle in the elevator car, and is said to be under the most perfect control. The smoothness of the motion of the elevator, both in increasing and decreasing the speed and in reversing the direction of motion, was particularly noticeable, and also the absence of the peculiar sinking sensation experienced in the modern high-speed elevator.

The Stirling Water Tube Safety Boiler, manufactured by the Stirling Company, Chicago, Ill., is shown in a descriptive catalogue, which presents to steam users in a brief, comprehensive manner, the design and points in its construction. There are many advantages claimed in regard to this boiler, particularly the fact that it is practically self-cleaning, a feature which is very important, as chemically pure water is thereby assured in the first and second bank of tubes. The shops of the company are located at Akron, O., and are equipped with all the appliances and devices for manufacturing and delivering boilers of any size. An office will be opened in Boston next week, which will be in charge of J. Bradford Sargent, who will represent the manufacturerers in the Eastern territory.

The Perret Electric Motor, manufactured by the Elektron Manufacturing Company, of Springfield, Mass., has recently been illustrated and described in a neat catalogue issued by the manufacturers since the plant and offices of the company were removed from Brooklyn to Springfield. This motor is manufactured in all sizes and for all purposes, where motors of the kind are used. The principal points of excellence claimed for it are high efficiency, low speed, full power, perfect automatic regulation, no sparking under changing load, extreme simplicity, durability and economy in working. The Elektron Manufacturing Company, with its new factory, which is said to be one of the finest and most complete in the country, has every facility for manufacturing and furnishing these motors of an improved standard, correct in detail and design, the result of skilled workmanship.

The Wheeler Condenser and Engineering Company, of 92 Liberty street, New York, has purchased the entire plant and business, including drawings and patterns, of the Colwell Iron Works, Carteret, N. J.; also the patents and good will of Mr. F. Meriam Wheeler, vice-president of the company. The Carteret plant is an extensive one, comprising a machine shop, iron foundry, brass foundry and pattern shop, all of which are equipped with the latest mechanical improvements and every facility for manufacturing machinery for sugar plantations and refineries, salt works, chemical works, etc., and for turning out castings in iron and brass. The location of the foundries is advantageous, being 15 miles from New York, offering the best of shipping facilities by water and rail The capacity of the foundries is 1,500 tons per month.

The Underwood Manufacturing Company, sole maker of the well known cotton leather belting, has shipped to Pittsburgh, for exhibition at the Street Railway Convention, a big cotton leather belt which is to go to the Chicago City Railway Company, being one of two belts made for that company. Its length is 200 feet, width 62 inches, and the belt speed is to be over a mile a minute. The same company has two 48-inch Underwood cotton leather belts, each 172 feet in length, which have been in use over four years, and have been run about 22 hours per day. The Engineering Equipment Company, of 143 Liberty street, New York, selling agent of the Underwood Manufacturing Company, has arranged to exhibit this big belt at Pittsburgh, and is represented by Mr. Crane, of the company's railway department. Mr. F. P. Mack represents the Underwood belting interests in Chicago, at 65 South Canal street.

The Electric Merchandise Company, of 11 Adams street, Chicago, Ill., reports for the last week sales of Burton electric heaters to the following roads: Spokane Electric Railway, Spokane, Wash.; Danville Electric Railway, Danville, Ill.; Stillwater Electric Railway, Stillwater, Minn.; Terre Haute Street Railway Company, Terre Haute, Ind.; Burlington Electric Railway, Burlington, Ia.; Reading and Southwestern Railway, Reading, Pa.; Eau Claire Street Railway, Eau Claire, Wis.; People's Street Railway, Springfield, Ill.; Salt Lake Rapid Transit Company, Salt Lake City, Utah; Minneapolis Street Railway Company, Minneapolis, Minn.; Electrical Supply and Construction Company, Pittsburgh, Pa.; Pullman Palace Car Company, Pullman, Ill.; Windsor and Sandwich Railway, Windsor, Can. Electric heating by the Burton company's process is said to be a complete success, and advantage of this method of heating is being taken by managers of many electric roads throughout the United States.

The McCreary Electrical Specialty Company, of 136 Liberty street, New York, reports that it is doing a most satisfactory business in the line of novelties which this company handles exclusively, many of which are patents which it controls. Constant effort is directed toward adding any new novelties and improvements in the line of electrical specialties, among which may be mentioned a flexible chain for covering flexible cord designed in brass and nickel. A new wrinkle in reflectors, made to fit Argand burners, stands for parlor tables and other novelties in brass and nickel are shown. This company shipped this week, 32 "Mogul" reflectors, 100 c. p. capacity, to Vermont, where they are to be set in the ceiling of an Episcopal church. An order for $1,000 was also received from the Northwest. The Almond flexible bracket, the moisture proof socket and new fixture cut-out meet with ready sales. The "dark room" for exhibition of specialties is now complete and a cordial invitation is extended to all to visit it.

The Solid Steel Car Wheels manufactured by the American Steel Wheel Company, 143 Liberty street, New York, have been subjected to some very severe tests for breakage and the expansion and contraction of the metal. One test was made by placing a 33-inch wheel on two solid iron blocks, the rim resting on each block. A weight of 525 pounds was dropped from a height of 17 feet, striking the hub 25 times without any perceptible effect except battering the metal. It was then dropped 10 times on the rim, without a fracture. A weight of 1,400 pounds was dropped from a height of 17 feet, striking the wheel 11 times, but failed to break it. It was acknowledged by those who witnessed the test that the results showed the wheel to be practically indestructible. At another exhibit, in order to test the expansion and contraction of the metal, a wheel was buried in sand and a charcoal fire built around the tread until it was brought to a red heat; then it was taken out and exposed to the atmosphere, which had no effect on it whatever. The testing committee decided that the wheel is a perfectly safe one under all circumstances.

The Sioux City Engine Works, of Sioux City, Ia., reports that in spite of the financial depression in the country its business has kept up in a satisfactory manner, the company having been obliged to work a night shift almost constantly for the past four months. During the past month orders have been placed for the following: One 150-h. p. Sioux City Corliss engine and one 150-h. p. Stirling water tube boiler to J. H. Hertsche, of Hamburgh, Ia; one 50-h. p. Giddings automatic and one 80-h. p. return tubular boiler to the Commercial Electric Power Company, of Lincoln, Neb.; one 100-h. p. Stirling boiler to the Sioux City Oat Meal Company; one 50-h. p. Sioux City Corliss and two 80-h. p. Stirling boilers to the Fremont Brewing Company, of Fremont, Neb.; one 12 × 18 Giddings automatic (fourth engine) to the Moline Plow Company, of Moline, Ill.; one 100-h. p. Giddings automatic compound engine for the Nebraska State University, at Lincoln, Neb., together with several other sales which will be closed within a few days. In addition to the above a 60-h. p. Giddings automatic compound has been placed in the company's works, which retains the same elements of simplicity for which the standard Gidding's automatic has become so popular. The trade on the Sioux Corliss engine is growing toward the larger sizes, and some of the stiffest and heaviest engine beds built in this country are being brought out, especially designed to withstand the heavy, fluctuating loads of electric railway service. Negotiations are being made with several large roads to furnish a new design 48-in. stroke Corliss engine up to 350 and 400 h. p., these same sizes being built by this company up to 500 h. p. or in pairs of 1,000-h. p. capacity. From present indications it would seem that the output of the works will double that of last year.

The Fitchburg Steam Engine Company, of Fitchburg, Mass., reports business as being exceedingly good, and that it has a large amount of work on hand. The company expects to remove its plant to its new works very soon. The company has recently shipped a 600-h. p. cross compound condensing engine to the Powelton Electric Light Company, of Philadelphia, this being the third engine of the kind which has been shipped to it. Also two 60-h. p. engines to the Norman Paper Company, of Holyoke, Mass., and expects to soon ship two large engines for the W. C. T. U. Temple in Chicago, Ill. The following orders have been received recently: Two large engines for the American Sugar Refining Company, to go in at the Havemeyer Company's works in Brooklyn; a 175-h. p. engine, Sayre & Fisher, of Sayresville, N. J.; also 150-h. p. engine including boilers, etc., for Geo. W. Sharer, of Little Washington, N. J.; two large tandem compound high speed engines for L. W. McCormack, of Chicago, Ill.; 125-h. p. engine for the Revere Rubber Company, of Boston; a 75-h. p. engine for Keasbey & Mattison, of Ambler, Pa., this being the fourth engine shipped them; also 50-h. p. engines for the Meriden Curtain Fixture Company, of Meriden, Conn.; Wilcox, Crittenden & Co., of Middletown, Conn., and L. Sartelle & Son, of Pepperell, Mass.; also orders for smaller engines for the Rockland Building Association, of Rockland, Me.; J. D. Bergen & Co., of Meriden, Conn.; C. T. Sampson, Manufacturing Company, of North Adams, Mass.; John Bower, of Philadelphia; Hollingsworth & Whitney, of Boston, and the Northampton Emery Wheel Company, of Leeds, Mass. Large compound engines for Gallup & Houghton, of North Adams, Mass., have been started recently besides many large engines in Philadelphia and immediate vicinity.

Business Notice.

The following prices are made for the No. 1 Universal Milling Machine, made by Brown & Sharpe, Providence, R. I.: Without overhanging arm, $480; with overhanging arm, $495. Previous prices, $550 and $585.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

U. S. PATENT ISSUED OCT. 6, 1891.

460,599. Electrode for Secondary Batteries; William A. Rosenbaum, of Jersey City, N. J. Application filed Dec. 31, 1890. A secondary battery electrode consisting of the combination of an envelope, a metallic frame inclosed thereby, and tablets of active material held in said frame. (See illustration).

U. S. PATENTS ISSUED OCT. 13, 1891.

460,942. Trolley-Catcher for Electric Cars; Wm. L. Browne, of Boston, Mass., Assignor of one-half to Geo. E. Costello, of same place. Application filed June 26, 1891. This invention has for its object the prevention of a trolley rising when it accidentally leaves the wire, and hence prevent it from catching in or striking the guard-wire.

460,958. Electric Signal for Railway Trains; Lawrence Dunn, of Fort Smith, Ark. Application filed Feb. 18, 1891. This invention consists of an electric metallic circuit extending through a train and operated by a suit-motor, and in which circuit is placed a signal-bell on the locomotive, and push-buttons or equivalent devices for closing the circuit, located at various convenient points throughout the train.

460,962. Electromagnetic Separator; Gustave M. Gouyard, of Leadville, Colo. Application filed Jan. 6, 1891. In a magnetic separator, the combination, with a plurality of magnets connected in series and each set of magnets connected to a separate plate or division of the commutator, of a commutator having a separate plate or division for each set of magnets and a pair of brushes therefor, whereby the working magnets are all of one polarity, which polarity is changed when the magnets pass the brushes.

460,963. Combined Electric Clock and Thermoscopic System; Henry Jansen Haight, of New York. Application filed March 7, 1887. A plurality of synchronously movable clock mechanisms and an equal number of recording tablets operated, respectively, by said clock mechanisms, in combination with a plurality of simultaneously and uniformly acting indicators corresponding in number with said clock mechanisms, andan equal number of markers, each of said markers being actuated by one of said indicators and marking upon one of said tablets.

460,972. Rheostat; Otto A. Kessner, of Newark, N. J., Assignor to the Hanson and Van Winkle Company, of New Jersey. Application filed March 18, 1891. This invention consists of a board provided on its upper surface with a continuous spiral of conducting material and a connecting piece also of conducting material arranged to slide longitudinally on an operating-arm and making electrical connection with the spiral, the circuit terminals being connected with one end of the spiral and with the pivotal post of the handle, whereby the entire length of the spiral or a part thereof is interposed in the circuit, which is either a main circuit or a shunt, and the force or power of the current can be gradually increased or decreased with accuracy and ease. (See illustration).

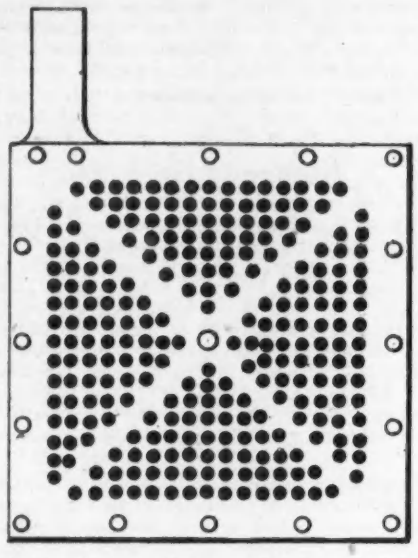
460,978. Electric Soldering Iron; Willis Mitchell, of Malden, Mass., Assignor to the Butterfield-Mitchell Electric Heating Company, of Boston, Mass. Application filed Jan. 9, 1891. In an electric soldering iron, the combination of a wire forming part of an electric circuit and wound in concentric helices, which are separated by strips of insulating material, with an inclosing casing for said helices and a soldering point in proximity thereto, so as to be heated thereby.

460,980. Electric Heating Core for Smoothing Irons; Willis Mitchell, of Malden, Mass., Assignor to the Butterfield-Mitchell Electric Heating Company, of Boston, Mass. Application filed March 24, 1891. In combination with a wire forming part of an electric circuit and wound in a heating coil or spiral, a solid core of insulating material which is grooved to receive the said wire and provided with a passage permitting the return of the wire to the end of the core where the winding began.

460,989. Fuse-Box for Electric Lamps; Arnold B. Holmes of Boston, and George F. Gale, of Winthrop, Mass. Application

filed April 15, 1890. A fuse-box comprising a fixed section provided with conducting plates separated by a dovetail groove extending across the inner face of said section, in combination with a movable section provided with a block fitted to enter the groove, and spring electrodes having fusible connection with the lamp wires and adapted to engage said conducting plate.

460,991. Incandescent Electric Lamp; Albert L. Reinmann, of New York, Assignor to the Westinghouse Electric and Manufacturing Company. Application filed Feb. 11, 1891. The method of making incandescent electric lamps having leading-in wires composed of two sections of platinum wire with an intermediate section of copper wire, which consists in forming a glass seal around the lower section of the platinum wire, surrounding the copper sections with glass tubes having vent openings in the sides, then sealing the upper ends of the tubes around the upper platinum sections, then closing the vent openings, securing the



No. 460,599.—ELECTRODE FOR SECONDARY BATTERIES.

carbon conductor to the leading-in wires, and sealing the mount so formed into the lamp bulb in the usual way.

461,023. Electric Battery; Daniel Martin Lamb, of Boston, Mass. Application filed Dec. 7, 1889. The method of preparing active material for electric batteries, which consists in enveloping the individual granules or particles thereof with a water-repellent substance, such as resin.

461,024. Composition for Electric Batteries; Daniel M. Lamb, of Boston, Mass. Application filed April 10, 1890. Battery active material consisting of powdered bichromate of soda, carbonate of soda, sal-ammoniac, sulphate of copper, free sulphur, black oxide of manganese, clay, gypsum and rosin, all pulverized, heated, mixed, and the resulting granules or particles thereby enveloped with the resinous water repellent material.

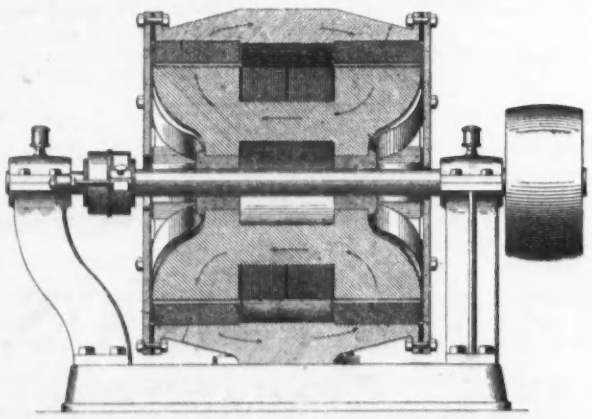
461,025. Electric Battery; Daniel M. Lamb, of Boston, Mass. Application filed July 23, 1890. A compound battery cell, consisting of a containing vessel, a series of independent cells therein, each enclosing a zinc electrode and a carbon rod, all the electrodes being connected in series and the spaces between them and the cells, and the cells and containing vessel, being filled with granulated active material having its individual particles each enveloped with water repellent material.

461,026. Compound for Electric Batteries and Method of Preparing the Same; Daniel Martin Lamb, of Boston, Mass. Application filed May 26, 1891. The method of preparing active material for electric batteries, which consists in coating each separate granule with water-repellent material, and then mixing such coated material with other ingredients not so coated.

461,027. Electric Battery; Daniel Martin Lamb, of Boston, Mass. Application filed May 26, 1891. The combination in an electric battery, of granulated active material, a resinous water-repellent substance individually enveloping each granule, a neutral exciting fluid, such as water, electrodes immersed therein, and envelopes, therefor, of absorbent paper to protect the electrodes from obstruction.

461,052. Electromagnetic Brake; Alton J. Shaw, of Milwaukee, Wis. Application filed July 2, 1891. In combination with an electric motor and with a brake drum or disc, a brake shoe or band adapted to bear upon said drum or disc and to prevent the rotation of the same, a pressure device serving to force and hold the brake shoe or band against the drum or disc, a lever provided with an inclined face of varying angle to work against and force back the shoe and release the band, an electromagnet connected with the source of supply of said motor, and an armature carried by the lever and arranged within the field of attraction of the electromagnet.

461,087. Electrical Automatic Fire Extinguisher for Buildings; William H. Soley, of Philadelphia, Pa. Application filed Jan. 17, 1889. In an electrical valve opening device, in combination, a source of current supply, a thermostat in electrical connection with said source of current supply, a rod attached to the valve, an electromagnet, a weighted lever adapted to be held normally in a perpendicular position by the catch, an insulated pin upon said valve rod, electrical connection between the said pin and the thermostat, and electrical connection from the magnet



No. 461,140.—DYNAMO-ELECTRIC MACHINE.

to the source of current supply, said rod being in the line of travel of the lever when the catch is released.

461,089. Fire Extinguisher; Jas. Wolstonecroft and William H. Soley, of Philadelphia, Pa. Application filed Feb. 1, 1889. A weighted lever, a device for holding it against falling, a thermostat-magnet and trip hook for freeing it from said device, a trip lever actuated by the fall of said weighted lever, and a pivoted arm released by said trip lever, in combination with a cap, which is also a rose or sprayer supported by a rod bar, and a nozzle on which said cap fits for closing the same, but which is allowed to discharge through and above said cap when the latter descends.

461,104. Electric Signaling Apparatus; Eugene G. Mettler, of Indianapolis, Ind., Assignor by direct and mesne assignments of one-half to Frederick L. McGahan, of same place, and Henry C. Bailey, of Edinburg, Ind. Application filed Oct. 15, 1890. An electric signaling apparatus comprising an electro-magnet set in the main circuit between the dynamo and the mechanism to be operated upon, the core of such magnet weighted and provided with a numbering tag at its lower end, its upper end connected to a steam whistle, the latter suitably connected to the steam supply.

461,135. Electric Inductional Transformer; William Stanley, Jr., of Pittsfield, Mass. Application filed Jan. 16, 1891. A sectional transformer core composed of detached plates or groups of plates held loosely in their supports, so as to be capable of mutually independent self-adjustment in planes substantially parallel with their respective surfaces. (See illustration.)

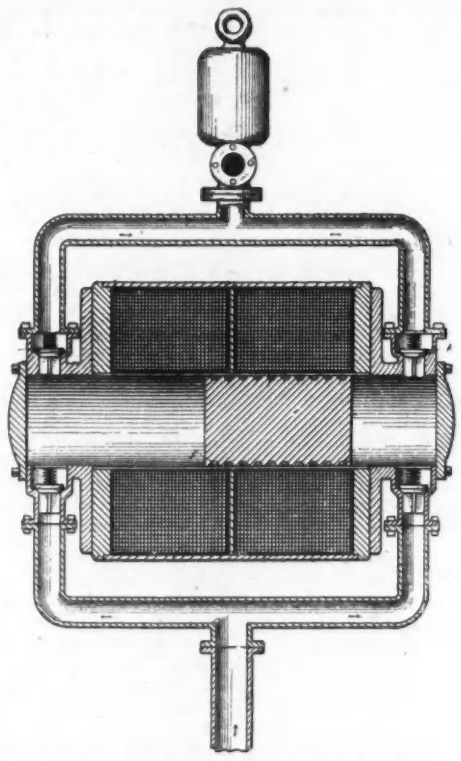
461,139. System of Distributing Electric Energy; Rankin Kennedy, of Glasgow, Scotland. Application filed Sept. 24, 1890. In a system of electrical distribution two armature windings which alternately traverse the same or similar magnetic fields, whereby alternating electrical pulsations of unlike phases are induced in the respective windings, in combination with independent pairs of main conductors, independent commutators, whereby the alternating pulsations induced in the respective windings are rectified before traversing the respective pairs of main conductors, a conductor directly uniting one positive brush of one with one negative brush of the other of said commutators, and translating devices connected between the conductor connected with the other positive brush of one pair and the conductor connected with the other negative brush of the other pair of mains.

461,140. Dynamo-Electric Machine; Rankin Kennedy, of Kilmarnock, Scotland. Application filed Oct. 30, 1890. In a dynamo-electric machine or motor, the combination of a field magnet having multiple poles disposed in two groups of opposite polarities, each of said groups being composed of a plurality of radial polar extensions, two annular laminated armatures having a radial thickness not less than half the breadth of the faces of the radial poles, and a cylindrical iron shell inclosing and supporting said armatures and serving to concentrate the magnetic lines. (See illustration.)

461,144. Electric Arc Lamp; Elihu Thomson, of Swampscott, Mass., Assignor to the Thomson-Houston Electric Company, of Connecticut. Application filed June 14, 1890. The combination in an electric lamp of a positive feed gear, such as a worm and screw, a pivoted frame sustaining one member of the gear and the carbon carrier connected with said member, an electromagnet for actuating the frame to bring the two members of the gear into engagement and form the arc, and a derived circuit actuating magnet for operating the other member of the gear to cause a feed of the carbon.

461,152. Telautograph; Max Soblik, of Berlin, Germany, to Paul Adolph, of same place. Application filed March 23, 1891. This invention consists in arranging a shaft both at the transmitting and receiving stations, so that both shafts are set in motion simultaneously by means of an electric current, and thereby cause two pins or styles to reciprocate in a simultaneous and identical manner, one of which is guided at the transmitting station by an insulating surface having the design or writing to be copied formed upon it, whereas the other style, arranged at the receiving station, is alternately moved by the electrical undulations to and from the surface to be written or drawn upon.

461,169. Non-Interfering Fire Alarm Box; Frank F. Loomis, of Akron, O. Application filed May 1, 1891. In a signal box, a signal transmitter and a motor for driving it, and a non-interfering magnet, and a horizontally rocking armature ar-



No. 461,295.—ELECTRICALLY ACTUATED PUMP.

ranged when rocked in one direction to close the circuit through the signaling mechanism, and when rocked in the opposite direction to close a short circuit and cut said signaling mechanism out of circuit, combined with a shunt wheel arranged to revolve with the mechanism and rock said armature from one direction to the other.

461,178. Electric Boiler Alarm; Mathias Beckers, of Langerwehe, Germany. Application filed Dec. 24, 1889. In water level indicators for steam boilers, a clamp with rod and guide in which moves the box fixed in any suitable position by the set screw and containing a horizontally oscillating horseshoe magnet, circuit terminals actuated by the oscillating horseshoe magnet, and a magnetic float for actuating the said magnet.

461,194. Signaling Switch and Circuit; Jos. W. Stover, of New York. Application filed May 29, 1891. The combination, with a metallic circuit including signal transmitters and a current generator, of a ground branch taken from the circuit between the terminals of the generator, said ground branch containing the magnet of a drop or device serving as a circuit closer and a signal operated by said circuit closer, an emergency switch at each signal transmitter, said switches normally maintaining the circuit closed, but arranged to open the metallic circuit when operated, and each having ground contacts, and means for connecting one of said contacts to one side of the main line and then for connecting the other contact to the other side of the main line, whereby a call will be given whatever the condition of the circuit.

461,195. Connection for Electric Conductors; Joseph Dillon, of Larchmont, Assignor of one-half to H. J. Reilly, of New York. Application filed May 13, 1891. The combination of a disc-like holder apertured to receive electric conductors, a cover constructed to be applied to said holder, hooked fingers and lugs on said holder and cover, and a locking device to engage with said holder and cover to prevent the rotation of one upon the other.

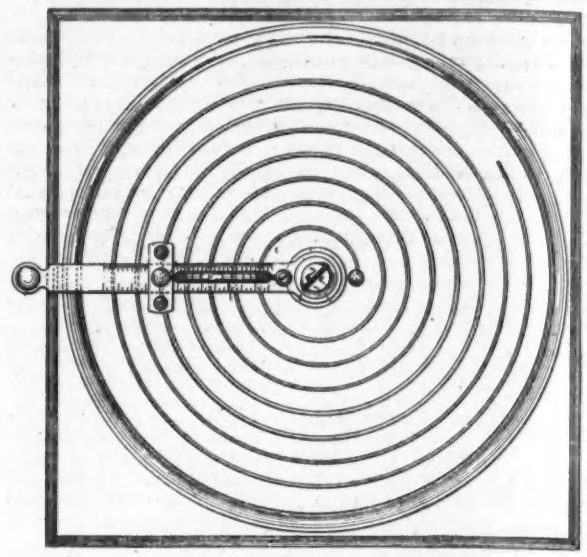
461,228. Electric Car Motor; George Willett, of Englewood, Ill. Application filed Dec. 22, 1890. In a motor, the axles of a truck, hubs loosely mounted on said axles, said hubs being provided with discs facing each other, on the faces of which are revoluble rolls, having a bearing on studs projecting from the discs, clutches splined to said axles, with suitable mechanisms for bringing said hubs and clutches into operative connection, in combination with the shaft of a motor, having worms attached to each end thereof, respectively, one of said worms being right-handed, and the other being left-handed, and one operating below one axle, and the other above the other axle, the right-handed worm actuating the truck through the mechanisms aforesaid in one direction, and the left-handed worm actuating the truck in the opposite direction.

461,229. Electric Meter; George Reade Baldwin, of New York. Application filed Nov. 20, 1890. In an electric meter, the combination of a lever, an adjustable fulcrum for said lever, a current indicating device which controls said fulcrum, a rigid backing piece by which said adjustable fulcrum is supported when the lever is forced down upon it, a registering device, and a clockwork, each connected to said lever.

461,239. Switch-Box; Horatio A. Foster, of New York, Assignor of one-half to John J. Moore, of same place. Application filed Oct. 24, 1890. The combination of a main distributing box, a subway switch-box connected therewith, and means for operating the switch extending from the switch-box to the surface, inclosed in and protected by a chamber or tube extending from the switch-box to the surface and terminating in a surface trap.

461,240. Dynamo-Electric Machine; Ezra T. Gilliland, of New York. Application filed Jan. 31, 1891. The field magnets and the supporting arms for the journal bearings for the armature are cast in one piece of iron in such manner as to permit the boring necessary to finish the machine ready for assembling to be done at one operation, and also to provide for the insertion of the armature and the coils of the field magnets into position in the frame.

461,262. Galvanic Battery; Phillip Hieronymus, of New York. Application filed Feb. 12, 1891. In an electric battery, the combination, with a jar, of a partition held a short distance above the bottom of the same, electric elements resting on said partition,



No. 460,972.—RHEOSTAT.

a tube for filling the lower part of the jar with water, a vent tube, and a wick for conducting the water from the lower part of the jar to the elements.

461,272. An Electric Conductor; Frank A. Perret, of Brooklyn, N. Y., Assignor to the Elektron Manufacturing Company, of same place. Application filed May 21, 1889. The invention consists in a metallic conductor coated with collodion, with an admixture of collodion in admixture with glycerine, or glycerine and a natural gum.

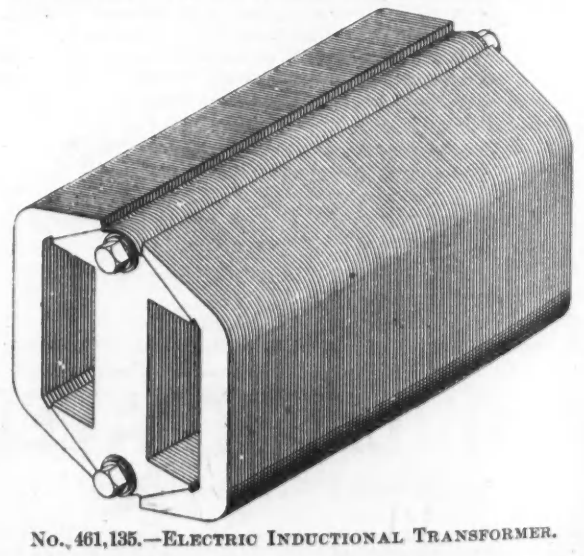
461,294. Automatic Electric Pump; Chas. J. Van Depoele, of Lynn, Mass. Application filed Feb. 26, 1891. An automatic electric reciprocating engine system comprising two sets of motor coils, a source of continuous current, separate connections between the source of current and the sets of coils, a magnetic piston adapted to be reciprocated through the sets of coils under their alternate action, a circuit closer at the engine, an electromagnetic circuit changer at the source of supply, and means actuated by the movements of the plunger for closing the circuit of the circuit closer on the completion of its desired movement in one direction, thereby shifting the current with the opposite set of motor coils, and vice versa.

461,295. Electrically Actuated Pump; Chas J. Van Depoele, of Lynn, Mass. Application filed March 27, 1891. An electrically actuated pump comprising a diamagnetic pump cylinder, a piston therefor of magnetic material, motor coils upon the exterior of the cylinder for moving the piston in opposite directions, and means for supplying current having a defined rise and fall to the coils in alternation. (See illustration.)

461,296. Armature for Electric Motors; Chas. J. Van Depoele, of Chicago, Ill. Application filed April 7, 1891. An armature for electro-dynamic motors, comprising a shaft, two discs or plates of non-magnetic material secured upon said shaft, an armature core having sectional winding thereon, independent divisional blocks between the sections of conductor, and connections between the ends of the blocks and the plates upon the armature shaft for sustaining the armature in operative position.

461,297. Actuating Device for Moving Commutator Brushes; Chas. J. Van Depoele, of Lynn, Mass. Application filed May 20, 1891. In an electro-dynamic machine, the combination, with the commutator and the main stationary commutator brushes, of auxiliary brushes and contact devices therefor carried by a concentric brush holder, said auxiliary brushes making a frictional contact and adapted to rotate their support about the commutator, a detent for arresting the rotation of the brush holder, and means for retracting the detent at desired intervals.

461,298. Electric Switch; Sterling P. Van Nort, of St. Louis, Mo. Application filed Nov. 21, 1890. The combination of an electric conductor connected with a lamp or other load and with ends in connection with two revoluble metal eccentrics on the same shaft insulated from each other, two levers in an electric circuit



No. 461,135.—ELECTRIC INDUCTIONAL TRANSFORMER.

having contacts at their free ends, and parts adapted to receive the impact of the eccentrics.

461,371. Fire Alarm Apparatus; William Cass Shaffer, of Milwaukee, Wis. Application filed Dec. 14, 1888. The invention consists of an automatic electric signaling apparatus, the combination of a main circuit supplied with current from a single source or battery which has a ground connection on one side, a branch circuit being a ground connection and a connection with the main circuit which supplies it with current, said branch being provided with suitable circuit-controlling devices, and signal-transmitting mechanism comprising a break-wheel, a contact-piece by which the circuit is alternately broken and closed when the break-wheel is turned, and electromagnet having its windings in said branch, and mechanism connecting the armature of said magnet with the break-wheel and arranged to actuate the same.

Copies of the specifications and drawings complete of any patent mentioned in this record—or of any other patent issued since 1886—can be had for 25 cents. Give date and number of patent desired and address The W. J. Johnston Co., Ltd., Times Building, N. Y.